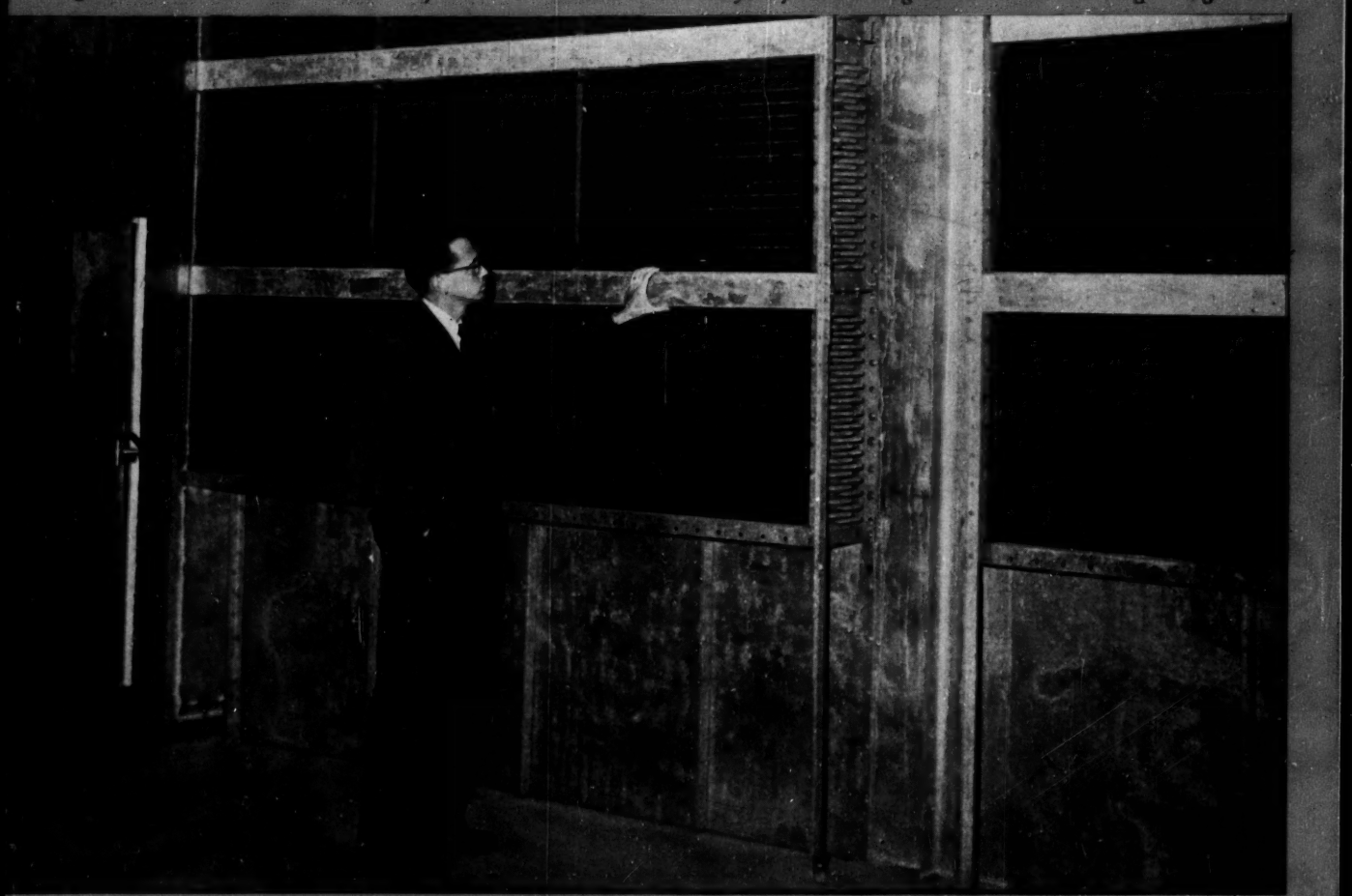
Heating Piping & Air Conditioning

FEBRUARY ★ 1954

INDUSTRIAL • COMMERCIAL • INSTITUTIONAL • PUBLIC BUILDINGS

Page 111—Journal Section of The American Society of Heating and Ventilating Engineers



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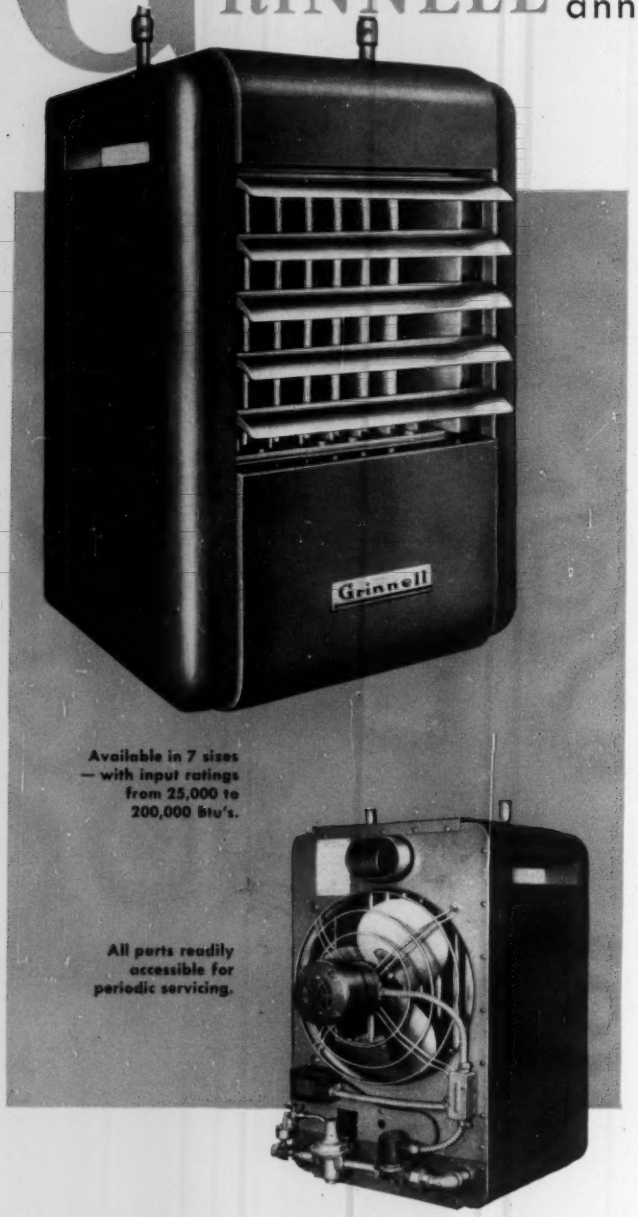
GRINNELL announces its new line of

GAS-FIRED UNIT HEATERS



Available in 7 sizes — with input ratings from 25,000 to 200,000 Btu's.

All parts readily accessible for periodic servicing.

AUTOMATIC! EFFICIENT! ASSURE YEARS OF DEPENDABLE SERVICE

Grinnell gas-fired unit heaters are easy to install, simple to operate and maintain. Efficient performance assured — with any type of gas — by modern design of burners and heat exchanger, proper motor and fan unit.

Automatic safety pilot operates to shut off main gas supply if pilot burner goes out. Flashback and extinction noise prevented by the burners' raised port design and proper port size for the gas used. Low speed motors have built-in thermal overload protection and automatic reset.

Additional features of Grinnell *gas-fired* unit heaters . . .

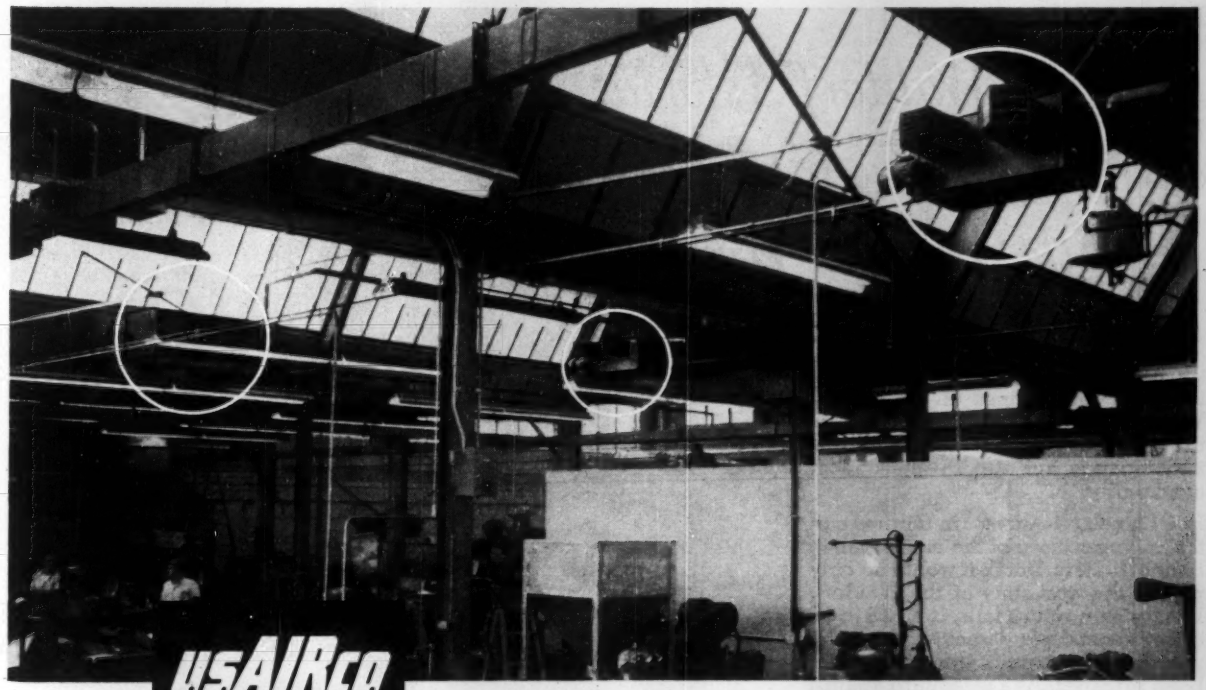
- Casing die-formed of heavy steel, with baked-on enamel finish
- Heat exchanger tubes and draft diverter of aluminized steel
- Combustion chamber of heavy steel, welded
- Burners of close-grained iron castings
- Adjustable louvers
- Burners and control assembly removable as a unit
- Hinged bottom pan permits cleaning interior of tubes
- Threaded pipe hangers for easy suspension
- Only wiring required is connection to room thermostat or manual switch
- Approved by the American Gas Association

WRITE FOR CATALOG

GRINNELL
UNIT HEATERS FOR STEAM, HOT WATER, GAS

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

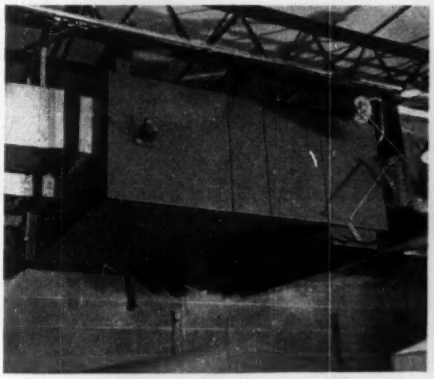
Manufacturer of: pipe fittings • welding fittings • forged steel flanges • steel nipples • engineered pipe hangers and supports
Thermolier unit heaters • Grinnell-Saunders diaphragm valves • prefabricated piping • Grinnell automatic fire protection systems



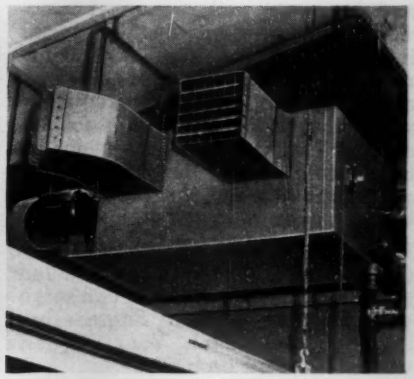
BH Type Heating and Ventilating Units solve large-space conditioning problem

Low cost installation and operation were the most important factors in the decision to install usAIRco's BH Type Heating and Ventilating units for Vandercook & Sons, Chicago manufacturer.

usAIRco BH Type Heating and Ventilating Units are adaptable to every job . . . co-ordinated sectional construction makes a limitless number of arrangements possible. Available sections include: blower, air intake mixing chamber, face and by-pass damper, by-pass duct, filter and coil sections. Floor or wall mounting is also possible. Available in 8 sizes, 1,200 cfm to 32,000 cfm. Contractor for Vandercook & Sons installation: W. A. Pope Co. Heating, Chicago. Architects: Johnson & Johnson, Chicago.



To heat this large factory area, 350 feet by 210 feet, with a 35-foot ceiling, 14 BH-210 units (5,000 cfm. 300,000 BTU) and two BH-212 units (6,750 cfm. 405,000 BTU) were suspended from the ceiling. Both are horizontal type with cowls.



To heat and ventilate the two lavatories, two BH-210 units with fresh air supply intakes were installed. Both units are equipped with non-freeze steam distributing coils and throw-away filters. Ductwork, before and after, serve air distribution.

for descriptive literature on BH units write Dept. HP 42

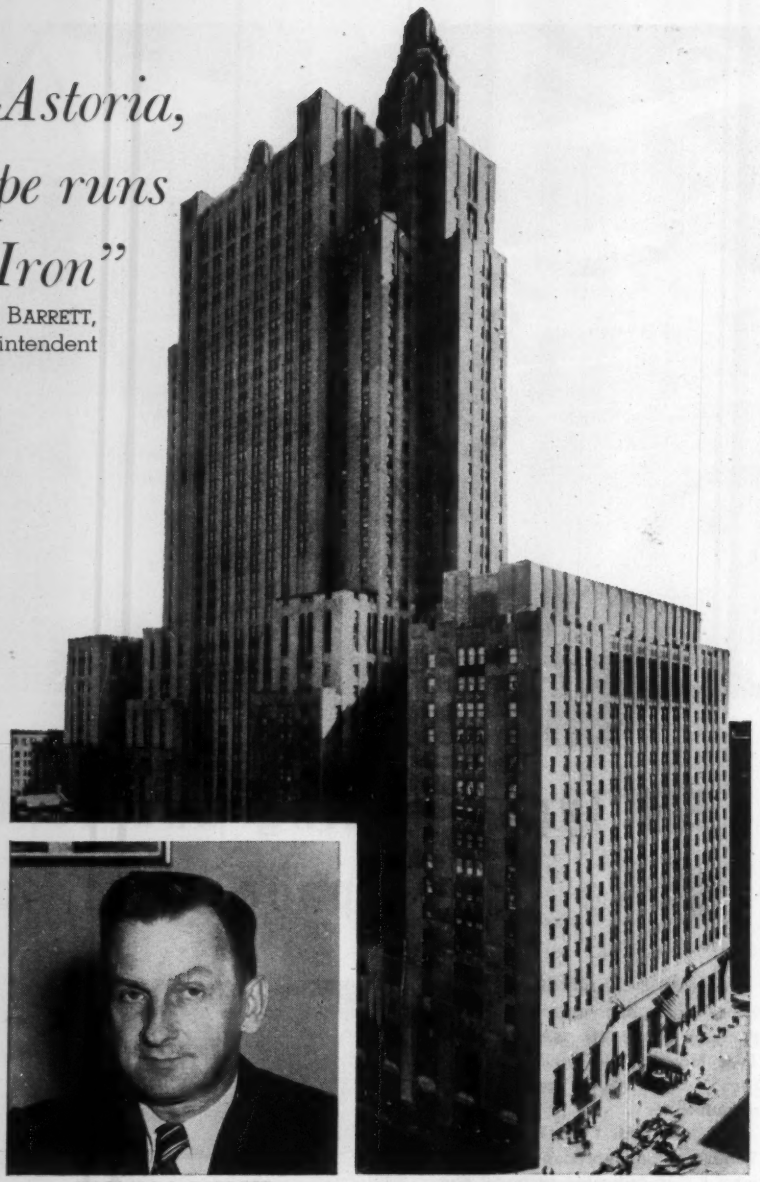
UNITED STATES AIR CONDITIONING CORPORATION

MINNEAPOLIS 14, MINNESOTA

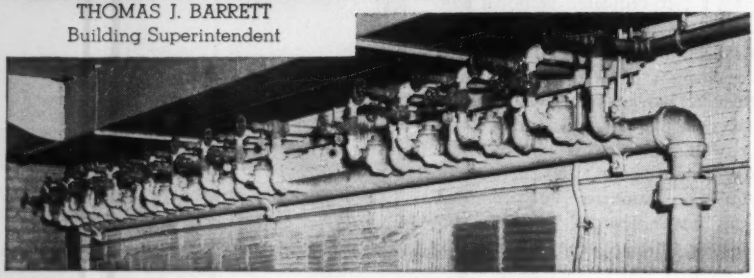
usAIRco
30 YEARS OF AIR CONDITIONING

"At the Waldorf-Astoria, we're replacing pipe runs with Wrought Iron"

—*says* THOMAS J. BARRETT,
Building Superintendent



THOMAS J. BARRETT
Building Superintendent



MR. BARRETT'S insistence on durability in steam return lines at the famous Waldorf-Astoria is an economy measure that pays off not only in lower maintenance but also in guest room availability.

In all hotels, steam return failures can take a large share of the maintenance budget dollars. But that would be only part of the cost story at the Waldorf. If one steam return fails, from 25 to 30 guest rooms are removed from the reservation list until the piping has been repaired. As a safeguard against this costly result of premature pipe failure, the Hilton Management has standardized on wrought iron pipe for all horizontal and vertical steam return replacements.

The wisdom of this choice is supported by outstanding wrought iron durability records in steam return lines in industrial, commercial and institutional buildings in every section of the country. Architects, engineers and designers, well aware that corrosion cannot be eliminated as a factor influencing pipe service life in steam return lines, even under the best operating conditions, are regularly specifying wrought iron pipe for the service. The continued acceptance by these professions is the best possible evidence of wrought iron pipe's ability to last longer, at lower cost per year.

If you are concerned with steam return piping, and would like a detailed report on how wrought iron can serve you better, write our Engineering Service Department. Your request will be handled promptly.

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, San Francisco. Export Department: New York, N.Y.

BYERS

CORROSION COSTS YOU MORE THAN WROUGHT IRON

WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS

Heating Piping & Air Conditioning

Vol. 26 No. 2

(with which is merged the Aerologist)

DESIGN, INSTALLATION, OPERATION AND MAINTENANCE IN INDUSTRIAL, COMMERCIAL, INSTITUTIONAL AND PUBLIC BUILDINGS

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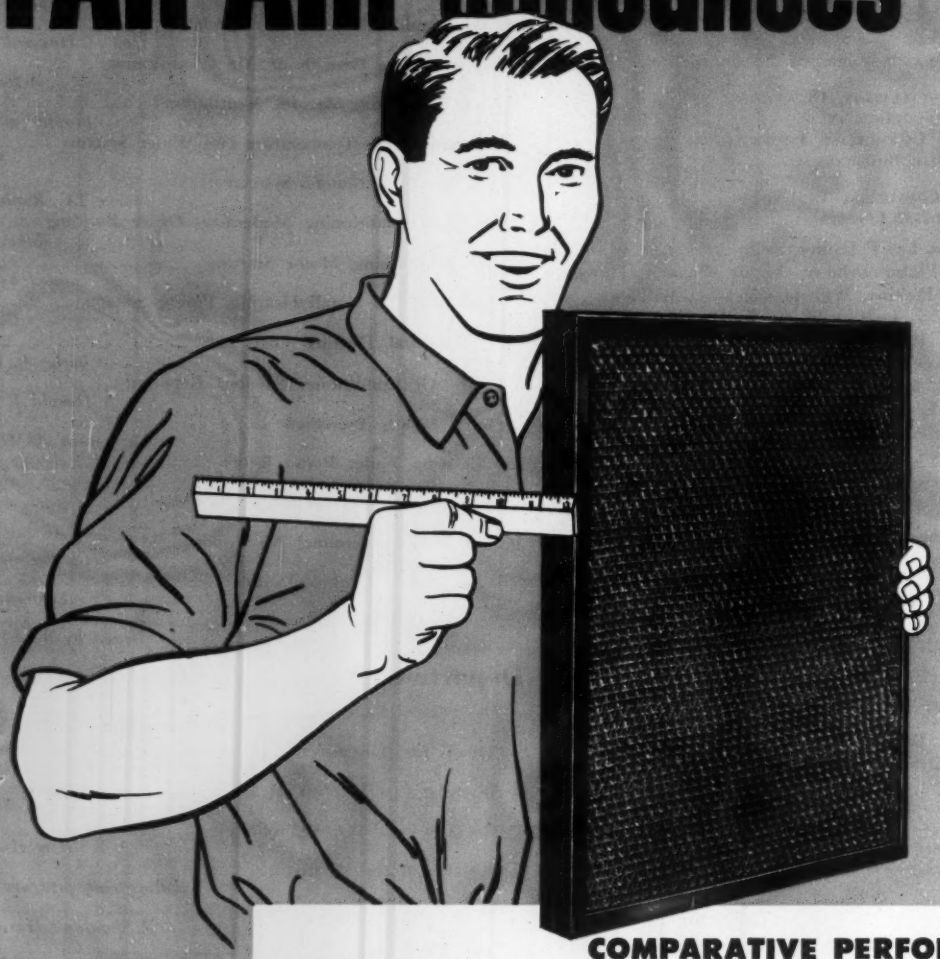
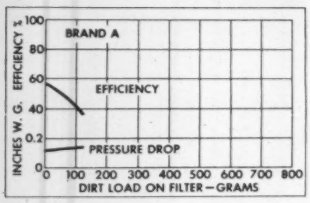
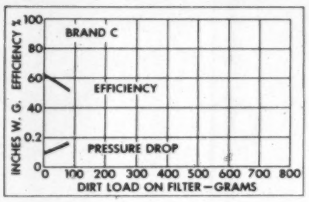
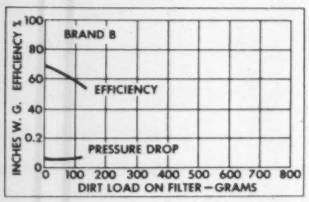


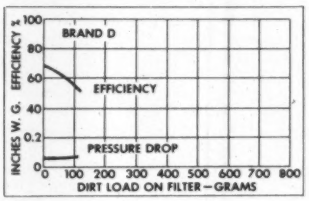
COMPARATIVE PERFORMANCE





ORDINARY 1" FILTER AT 800 CFM





ALL CURVES BASED ON 20x20x1" FILTERS

Better by FARR
Better buy FARR

high-low velocity 1" filter

HOLDS 7 TIMES AS MUCH DIRT AS OTHER 1" FILTERS

Filters half-again as much clean air because of 50% greater capacity
Gives sustained efficient performance with low pressure loss
Can be used at either high or low velocity

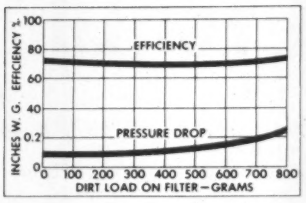
Here at last is a scientifically designed, proven, ruggedly built, all metal, high velocity 1" filter. It is no longer necessary to make extensive never-ending replacements . . . or put up with poor performance as ordinary 1" filters approach the useless point.

Based on the famous Far-Air herringbone design, this new gabled-crimp 1" filter is actually as efficient as most 2" types. Quantitative tests prove it's the best 1" filter on the market. It holds up to 800 grams of Standardized Fine Air Cleaner Test Dust before cleaning is necessary. Compare the curves—see for yourself it holds 7 times as much dirt as other brands. Far-Air 1" filters load progressively—like our 2"—and give you high efficiency air filtration without critical pressure loss right up to cleaning time. Cleaning is simple and easy. With reasonable care your Far-Air filters will last indefinitely.

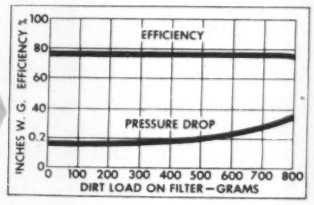
This new-type filter opens up new and exciting possibilities in many fields. Design engineers can now get higher quality performance in 1" frames. Equipment manufacturers can attain greater efficiency and economy in their products with ⅓ less space for filter units. Service organizations need make fewer calls to maintain safe, dependable air filtration for their customers.

Eliminate the wasteful expense of inefficient filters—save time and trouble—get better air filtration at lower cost. Write today for complete information. Farr Company, P. O. Box 10187, Airport Station, Los Angeles 45.

NEW FAR-AIR 1" FILTER AT 800 CFM



NEW FAR-AIR 1" FILTER AT 1200 CFM



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NO COMPROMISE ON QUALITY

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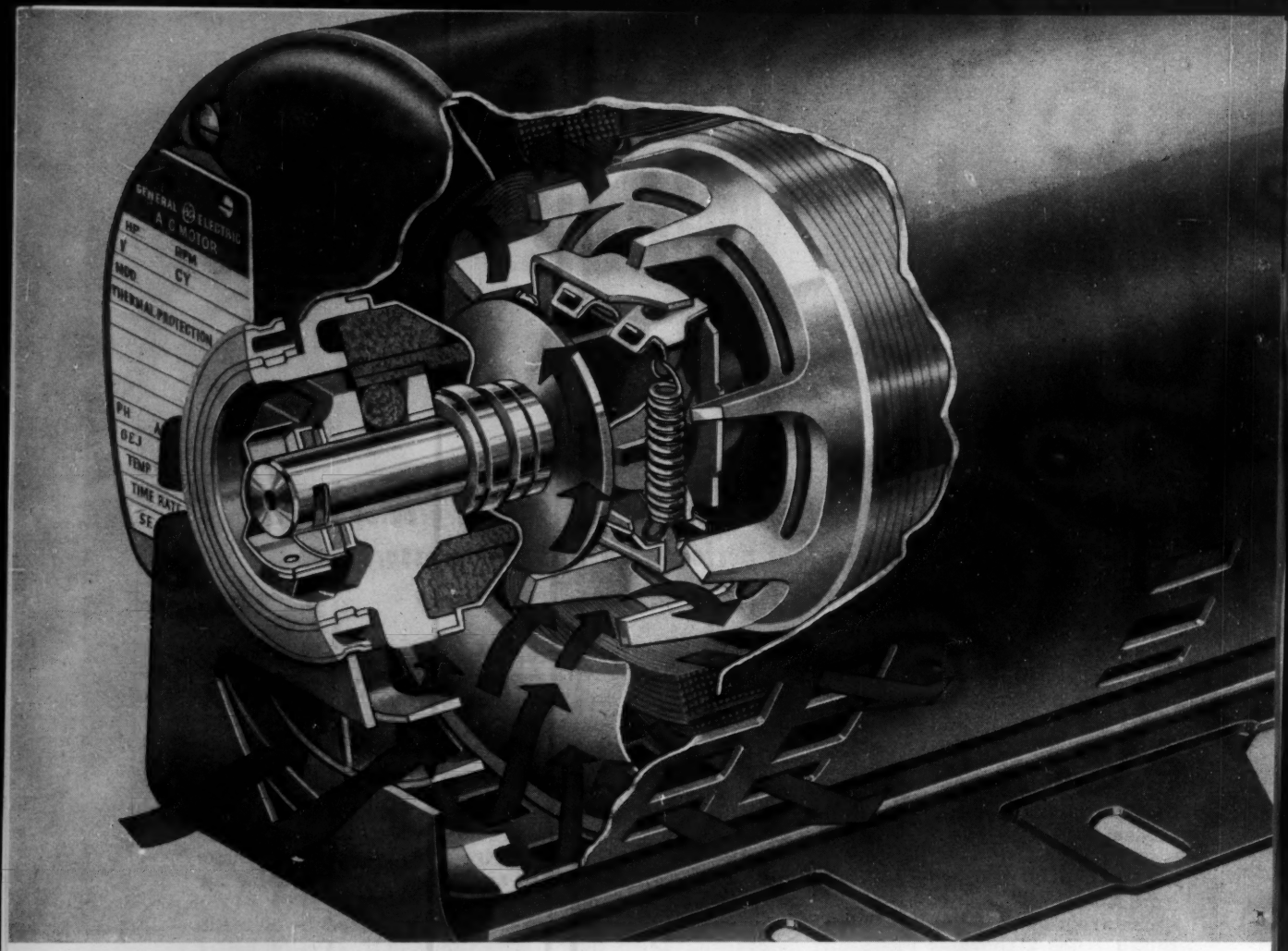


VENTILATION SYSTEM on new open drip-proof fhp motor pulls air in through end shield and first row of shell louvers. Baffle and fan uniformly direct the air over the windings and end rings where it absorbs heat . . . and exhausts it through the inside row of louvers. On the shaft end of the motor, air enters through the end-shield ventilating openings . . . absorbs the heat and exhausts it through the stator ventilating louvers. This controlled air flow permits more compact motor design.

New design, better ventilation

. . . reduce your assembly and shipping costs

From shipping, through storage and assembly, smaller sizes in the new G-E fhp motor line . . . as much as 40% smaller . . . bring you much easier handling and far greater economies. Applying an entirely new concept of electrical-mechanical design, the new G-E fhp motor line features an improved ventilating system that effectively dissipates heat from a reduced surface area.

In both open dripproof and totally enclosed fan-cooled motors, the ventilating system is co-ordinated as part of the basic electrical-mechanical design. This gives maximum power in minimum space.

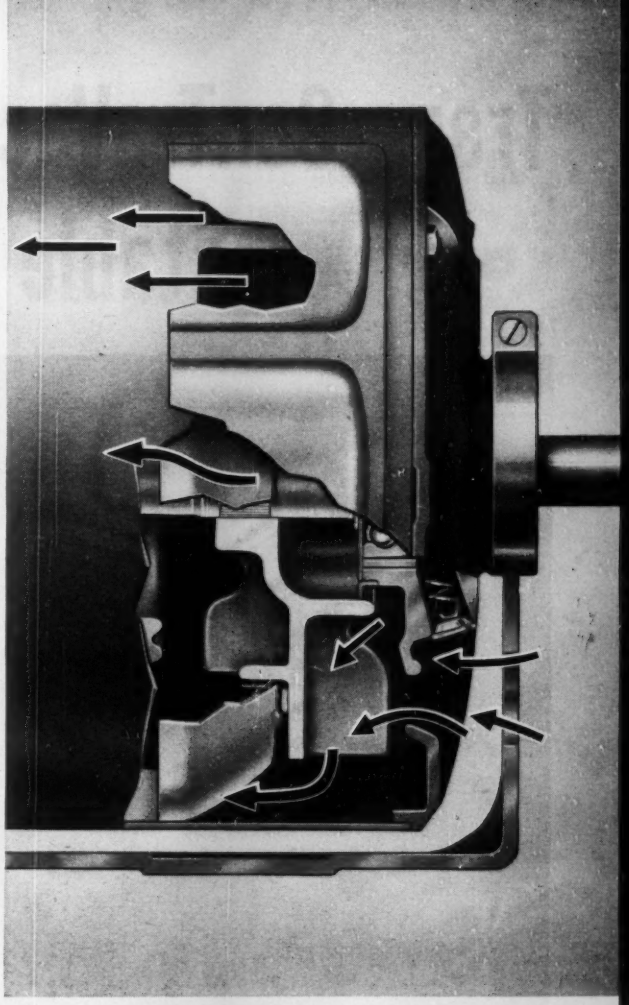
When you need motors, remember too that new G-E fractional-horsepower motors give you full NEMA performance, up to 50% less weight, all-angle operation, extra long life . . . the features you need for efficient, versatile motorization.

Find out more about the all-new G-E fhp line. Contact your nearest G-E Apparatus Sales Office, Authorized G-E Distributor, or write Section 702-4 for bulletin GEA-5567, General Electric Company, Schenectady 5, N. Y.

You can put your confidence in—

GENERAL ELECTRIC

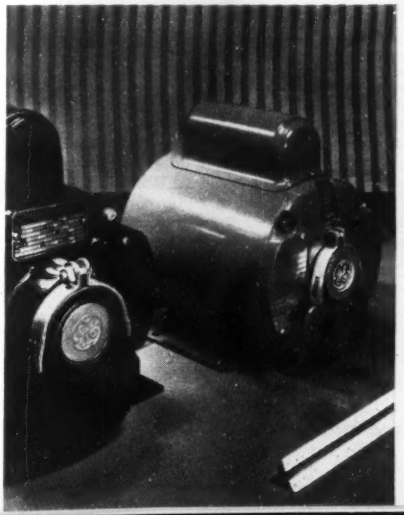
ELECTRICAL-MECHANICAL DESIGN applies new materials and techniques, providing full-rated power in smaller motor size. (1) Baffle channels air, helps prevent hot pockets. (2) Fan blades, cast integrally with the aluminum rotor windings, conduct heat from rotor for cooling.



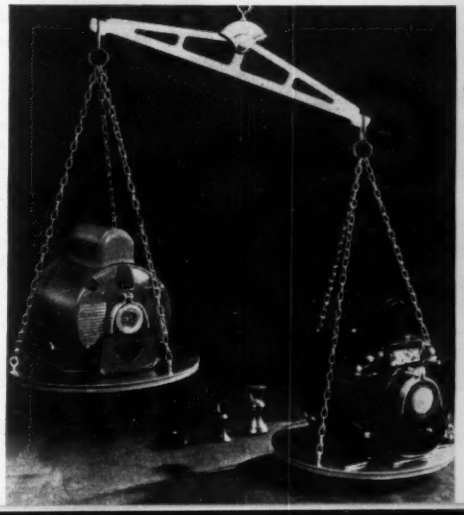
TOTALLY ENCLOSED fan-cooled fhp motors now feature both external and internal fans within stator shell. Air enters through open end shield, passes by dust-tight motor cover, and out special louvers which guide cooling blast along stator shell.

make G-E fhp motors smaller

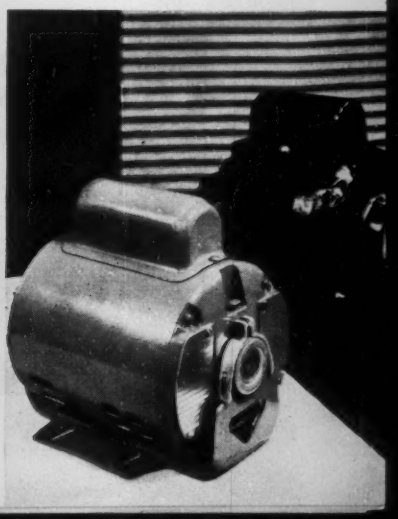
SMALLER



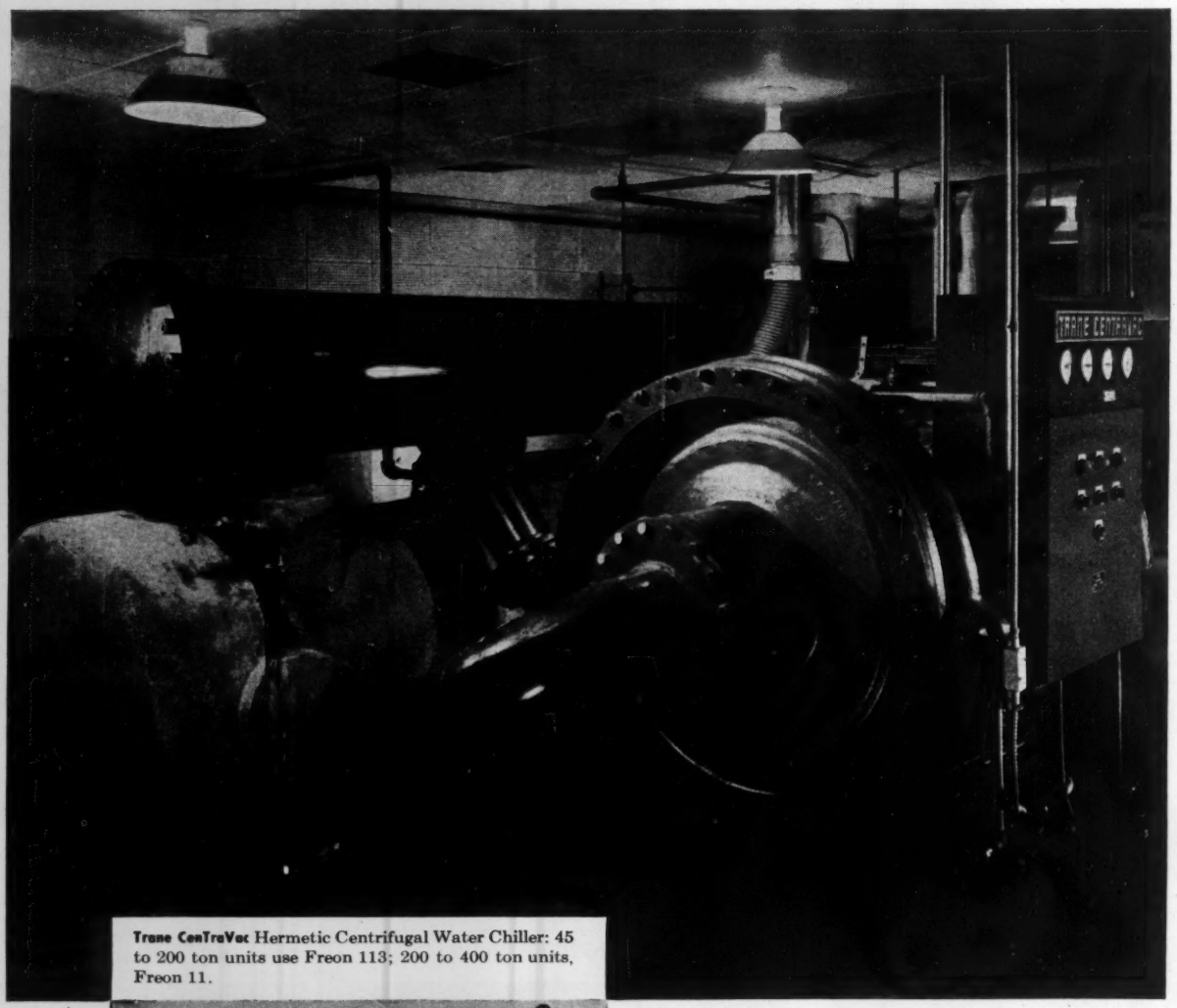
LIGHTER



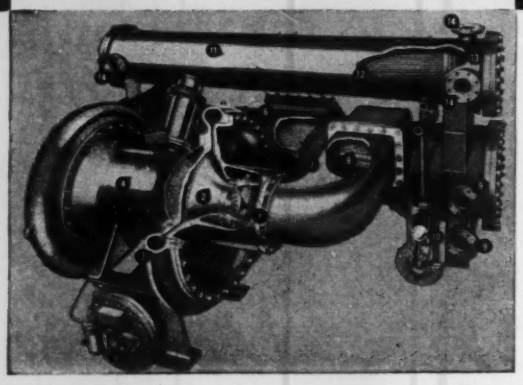
BETTER LOOKING



Trane CenTraVac centrifugal water stable operation down to



Trane CenTraVac Hermetic Centrifugal Water Chiller: 45 to 200 ton units use Freon 113; 200 to 400 ton units, Freon 11.



1) Vane control—permits operation down to 10% of rated capacity. 2) Impeller—assures high efficiency. 3) Volute housing—smooth gas flow. 4) Motor—hermetically sealed, eliminates shaft seals and gear boxes, gives quieter operation. 5) Lubrication system—fully protected from failure. 6) Evaporator—semi-flooded type. 7) Tube bundle. 8) Eliminator—prevents liquid carry-over. 9) Evaporator water connections—2, 3 or 4 pass, give flexibility for all water flow conditions. 10) Float valve—refrigerant flow control. 11) Condenser. 12) Tube bundle. 13) Water boxes—marine type. 14) Water connections.

chiller—assures 10% of capacity!

Now, with the CenTraVac, you can design a system that automatically adjusts to varying cooling requirements with power savings in almost direct proportion to load variations.

In any air conditioning system the design load exists only part of the time. The CenTraVac meets smaller load requirements by automatically throttling down smoothly—and in infinitely small increments — to as low as 10% of rated capacity. It allows, for the first time, partial operation without a large penalty in operating costs! For example:

At 80% load, power consumption is 77%; at 50%, it requires 50% power; at 10% load it requires only 22% power.

It is the only unit that permits *stable* operation over such a wide range (100% down to 10% of capacity).

Yet, wide capacity control is only part of the CenTraVac story. Here are more features that make the CenTraVac a wise choice for jobs from 45 tons up.

Automatic, unattended operation. Except where required by local codes, there is no need for a special engineer. Push a button to start. From there on the CenTraVac starts, stops and modulates automatically.

No costly multi-level base required. May be set directly on a level concrete floor of sufficient strength to support unit. No foundation bolts required.

Hermetic design. Eliminates need for shaft seals, gear box, heavy thrust bearings and couplings. Minimizes danger of costly refrigerant loss. Eliminates constant supervision and maintenance.

Protection against maintenance and installation errors. CenTraVac has only two main bearings. It is designed to operate only when full oil pressure is applied to both bearings. Compressor is factory aligned, eliminating this problem in the field.

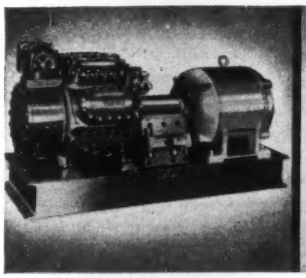
Integral load-limit control. CenTraVac has built-in load-limit control for full protection against overload under all conditions.

Packaged water chiller. CenTraVac is a complete unit. All parts are shipped together including refrigerant and oil charge. Installation requires a minimum of time.

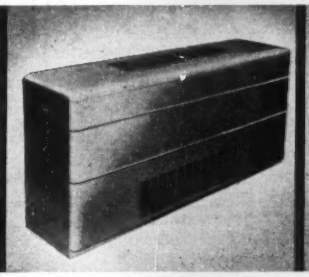
Inspect a CenTraVac installation

Your local TRANE Sales Representative will be pleased to arrange for you to see a CenTraVac in operation. Simply give him a call. For further data on the CenTraVac—including features, mechanical and engineering specifications, capacities, controls and rough-ing-in dimensions—contact your TRANE Sales Representative or write TRANE, La Crosse, Wis., for 42-page CenTraVac Bulletin DS-399.

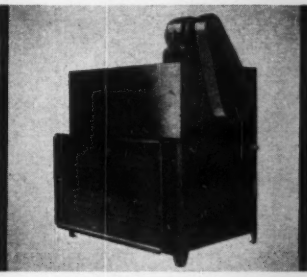
OTHER TRANE AIR CONDITIONING EQUIPMENT FOR JOBS OF ALL SIZES



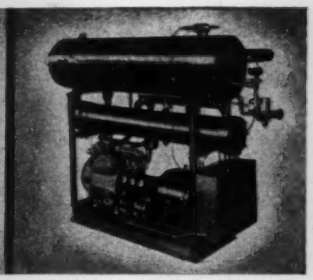
Reciprocating Compressors . . . cap. up to 50 tons. Automatic cylinder unloading saves power, permits multistep operation to 25% capacity.



UniTrane room units utilize chilled or heated water. Individually controlled for year-round air conditioning. Cabinet or recessed models.



Climate Changers . . year-round air conditioners that heat, cool, humidify, dehumidify, filter and circulate air. Capacities: 450 to 22,000 cfm.



Cold Generators . . . packaged water chillers. Completely wired, piped, charged and tested at factory. Six sizes from 10 to 50 h.p.

TRANE

Manufacturing Engineers of Air Conditioning, Heating and Ventilating Equipment

The Trane Company, La Crosse, Wis. • East. Mfg. Div., Scranton, Penn. • Trane Co. of Canada, Ltd., Toronto • 87 U.S. and 14 Canadian Offices

IMPORTANT FACTS ABOUT

...*the great*

MANUFACTURERS · WHOLESALERS · SERVICEMEN:

A YEAR AGO, General Chemical announced its entry into the refrigeration and air conditioning field as a primary producer of the two big "work horse" fluorine refrigerants: trichloromonofluoromethane and dichlorodifluoromethane—under the trademarks "Genetron" 11 and "Genetron" 12.

THIS WAS HIGHLY SIGNIFICANT NEWS. Until then, there had been only one manufacturer of these two basic refrigerants which are so essential to the Industry's existence.

WITH THIS SUBSTANTIAL NEW SOURCE, a strong, well-balanced supply exists for the first time. Now there will be sufficient productive capacity to serve all your refrigerant needs—both present and future.

EQUALLY IMPORTANT, you no longer face the hazard of crippling shutdowns that arises when there is a single producer of a primary component material. Instead, your interests are well protected, for not only is there a sound supply situation, but with it has come freedom of choice and assurance of superior product quality and fine service that always follows in the competitive American market.

SUCH FACTS ARE VITAL TO YOU whether you are a manufacturer, wholesaler or serviceman. Because of the importance of "Genetron" refrigerants to the Industry, many sound, logical questions have been asked about them and their producer.

Here are the answers:

genetron®...

new name in basic refrigerants

HERE IS A MESSAGE OF VITAL INTEREST TO YOU!

Who is General Chemical?

For over fifty years, General Chemical has been one of the nation's largest manufacturers of basic industrial chemicals, including sulfuric and hydrofluoric acids. It has almost 100 producing and operating locations across the country.

What is its background in Fluorine Chemicals?

A pioneer in the field, General Chemical is recognized as Industry's primary source of fluorine chemicals. It makes more than 90 organic and inorganic fluorine compounds for industrial and research applications, including the atomic energy program.

Is it qualified to make products of the high purity required in refrigerants?

Definitely. General Chemical also makes the country's leading line of high purity laboratory reagents and fine chemicals. Under its Baker & Adamson label, it offers over 1,000 such products —all made to meet quality specifications of "decimal point" exactness.

What is its raw materials position?

Ideal. General Chemical not only has its own mines and reserves, but is the foremost producer of hydrofluoric acid and elemental fluorine from which virtually all fluorine chemicals are made.

Where are "Genetrons" made?

At Baton Rouge, La., in one of the newest, most modern fluorine refrigerant plants in America.

What kind of service can I expect?

The best. General Chemical has 27 sales offices in major centers of commerce to serve you and handle your orders.

Does General also have regional warehouse stocks?

Yes. Stocks of "Genetron" refrigerants are at General Chemical warehouses at key points across the country.

Are the "Genetrons" "new" refrigerants?

No. "Genetron" 12 is the widely used refrigerant, dichlorodifluoromethane. This chemical has long been the mainstay of the refrigeration and air conditioning industry. "Genetron" 11 is trichloromonofluoromethane, second of the big "work horse" fluorine refrigerants.

Are "Genetrons" interchangeable?

Absolutely. "Genetron" 12 and "Genetron" 11 are identical and interchangeable in all respects with dichlorodifluoromethane and trichloromonofluoromethane produced by any manufacturer meeting the same high refrigerant standards.

Are "Genetrons" approved?

Certainly. "Genetron" refrigerants have been tested exhaustively by major manufacturers of refrigeration and air conditioning equipment in their own laboratories and are being used in their equipment.

What about their moisture content?

It's extremely low! General Chemical's special methods for producing "Genetron" refrigerants are so exacting that their quality is consistently better than indicated by these stringent manufacturing specifications:

	"Genetron" 12	"Genetron" 11
Moisture-wt. % max.	0.0010	0.0025

Is overall purity good?

Yes, it's the highest! The "Genetrons" are extremely pure chemicals manufactured to meet quality standards which are in many respects more rigid than those for the purest research chemicals.

What container sizes are available?

"Genetron" refrigerants are offered in the various standard container sizes required by manufacturers and wholesalers. "Genetron" 12 is shipped in 2,000-lb , 145-lb., 25-lb., and 10-lb. cylinders; "Genetron" 11 in 2,200-lb. cylinders and 200- and 100-lb. drums.

For further information

about "Genetron" refrigerants write or 'phone the nearest General Chemical office listed below. Ask for free Technical Service Bulletin 11-12A, "Genetron" Refrigerants.

Products of

GENERAL CHEMICAL DIVISION

ALLIED CHEMICAL & DYE CORPORATION

40 Rector Street, New York 6, N. Y.

Offices: Albany • Atlanta • Baltimore • Birmingham • Boston • Bridgeport • Buffalo • Charlotte • Chicago Cleveland • Denver • Detroit • Greenville (Miss.) • Houston • Jacksonville • Kalamazoo • Los Angeles • Minneapolis New York • Philadelphia • Pittsburgh • Providence • San Francisco • Seattle • St. Louis • Yakima (Wash.)
In Wisconsin: General Chemical Company, Inc., Milwaukee

In Canada: The Nichols Chemical Company, Limited • Montreal • Toronto • Vancouver

America's Foremost Producer of Fluorine Chemicals

Allied Chemical

POWERS *NEW* Unit Ventilator Control System

and now,

POWERS

offers another advance in

UNIT VENTILATOR TEMPERATURE CONTROL

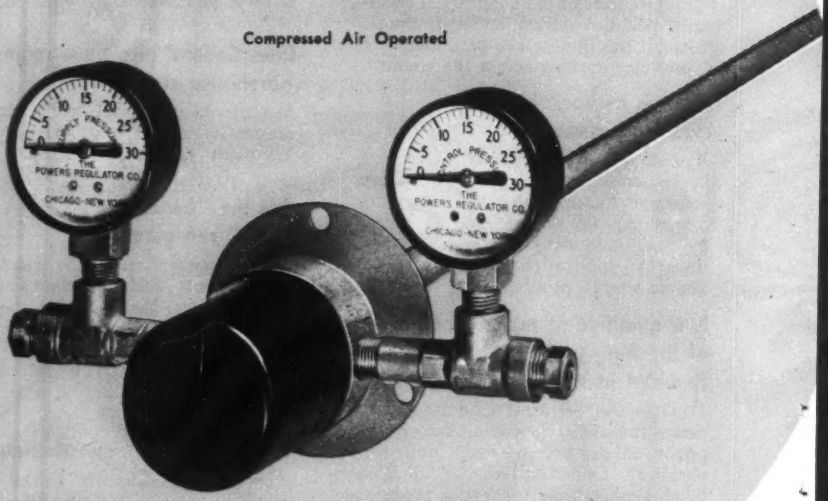
Gives More Accurate Control with LESS Maintenance

It's New!

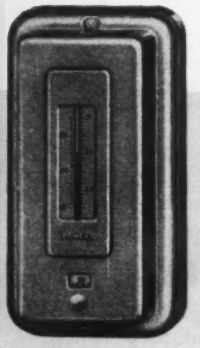
LIMITEM

LOW-LIMIT AIRSTREAM THERMOSTAT

Compressed Air Operated



A Precision Instrument **engineered to provide control for Unit Ventilator discharge temperatures — a critical requirement for classroom comfort.**

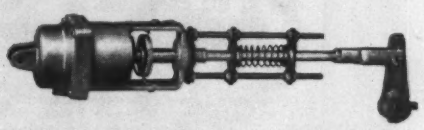


POWERS ROOM THERMOSTATS

are truly gradual-acting and give smooth control of valves and dampers. Day-Nite Thermostats with automatic change-over are available when required.

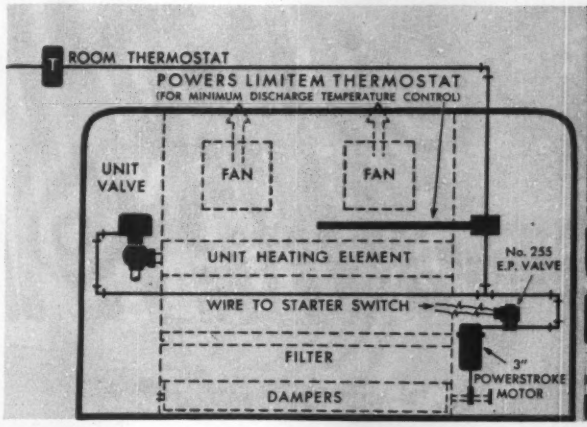
POWERSTROKE DAMPER OPERATOR

with hesitation spring gives smooth gradual operation of unit ventilator dampers.

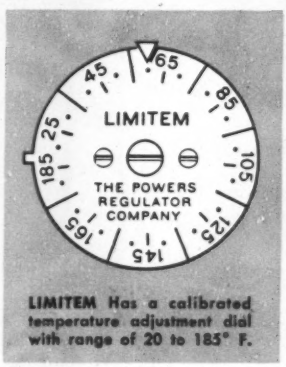


Eliminates OVER-heated Classrooms...

. . . INSURES UTMOST COMFORT AND FUEL ECONOMY



POWERS Temperature Control for Unit Ventilators



LIMITEM Has a calibrated temperature adjustment dial with range of 20 to 185° F.

. . . with its simple, direct control gives close regulation without using complicated auxiliary devices. Thermostats, packless valve and damper operator are all engineered to give many years of reliable, trouble free service.

New LIMITEM Thermostat is the most accurate instrument made for low-limit control of unit ventilators It incorporates such sound engineering principles as: Sturdy construction, Accurate Response, Ingenious non-bleed double air valve to insure stable control with low hysteresis and Adjustable Sensitivity to give precise throttling range.

POWERS PACKLESS Control Valves are now standard for unit ventilators and convectors. You get a really modern temperature control system when you use POWERS.

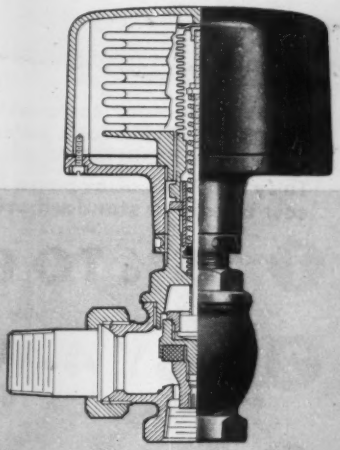
Contact your nearest Powers Office for engineering data and ask to see the new LIMITEM low-limit thermostat.

No More Steam or Water Leakage

No More Packing Maintenance

POWERS SPECIAL UNIT VENTILATOR CONTROL VALVES

Their **PACKLESS** construction reduces valve stem friction, eliminates packing maintenance and gives smooth control. High lift poppet provides 3 times as much travel (for a ½" valve) as compared with previous valves. Characterized throttling plug insures correct flow of steam or water over the full range of valve travel and is particularly effective at low capacity requirements—the most critical point.



POWERS Valves Are Carefully Sized for Each Unit.

THE POWERS REGULATOR CO.

Skokie, Ill. • Over Sixty Years of Automatic Temperature control

Offices in over 50 Cities in U.S.A., Canada and Mexico • See Your Phone Book

(b60)

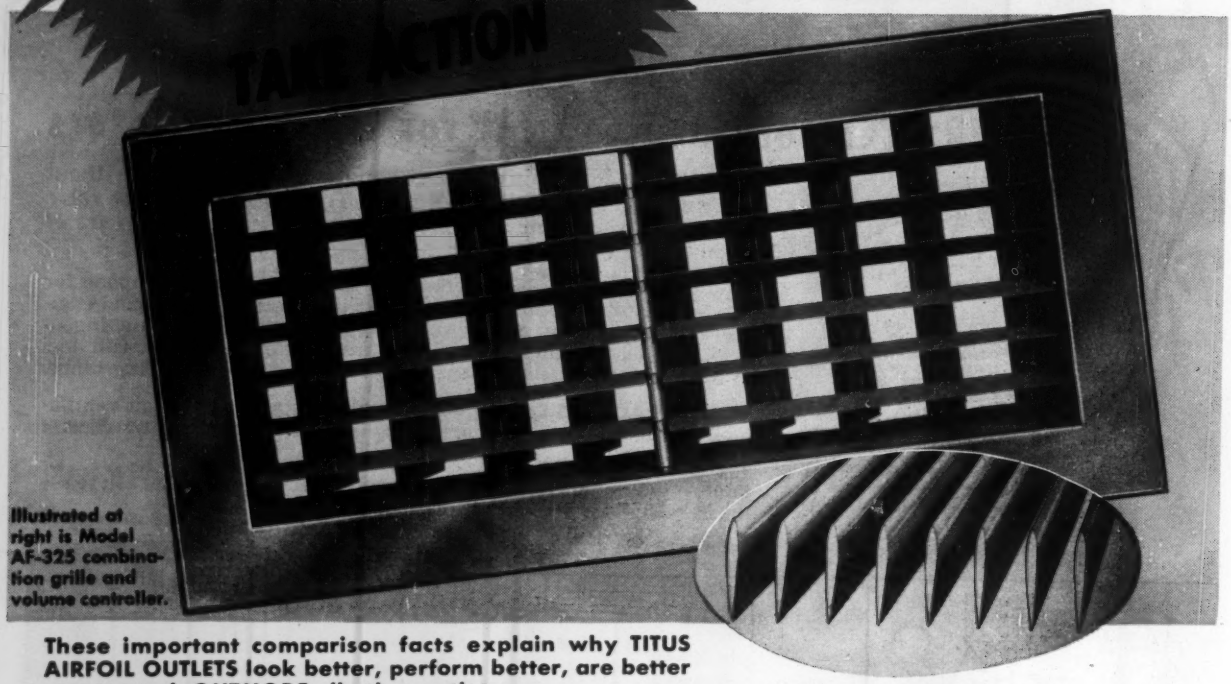
IMPORTANT MESSAGE

To everyone responsible for the specification and installation of air conditioning outlets.

IF YOU ARE GETTING LESS THAN EVERY SINGLE ONE OF THESE FEATURES IN EVERY OUTLET YOU USE...*YOU ARE NOT GETTING YOUR MONEY'S WORTH.*

...See for Yourself

COMPARE



Illustrated at right is Model AF-325 combination grille and volume controller.

These important comparison facts explain why TITUS AIRFOIL OUTLETS look better, perform better, are better constructed, *OUTMODE* all other outlets.

They are built above and *beyond* average demand, yet cost is kept at standard prices.

Illustrated above cutaway view showing solid section, streamlined Airfoil Louvers.

❶ 75% TO 85% FREE AREA . . . .

Greater than ordinary grilles.

❷ EASY 4-WAY ADJUSTMENT . .

Not necessary to remove or invert grille to get complete 4-way adjustment.

❸ INSTALLS IN 1/10 ORDINARY TIME . . . . . .

Workmen need not remove grilles. Dirty hands never touch grille or wall to leave dirty, expensive smudges.

ORDER *A Sample* TITUS GRILLE

FEATURE FOR FEATURE WITH EVERY OTHER GRILLE ON THE MARKET TODAY

4 SOLID SECTION AIRFOIL LOUVERS . . . . . Smooth as glass. Streamlined. Eliminate turbulence. Control air properly.

5 ONE-PIECE FRAME . . . . . . Adds new beauty to any installation. No unsightly corner cracks or corner patches.

6 EXTRA STRENGTH . . . . . . Without clumsy bulk. Easy to carry. Easy to handle.

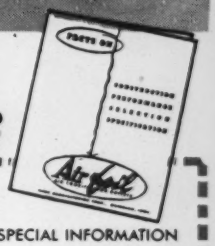
7 CLEAN WITHOUT REMOVING GRILLE . . . Removable core not necessary. Made available, however, if desired.

8 LOW NOISE LEVEL . . . . . . Streamlined louvers handle air with near perfect performance. Hold noise level to absolute minimum.

Before you start your next job, order a sample grille. Prove to yourself by *True* comparison . . . holding the grille in your hands . . . that you get better grille construction, more beauty, and consequent better grille performance from TITUS OUTLETS. ORDER TODAY.

***SALES OFFICES IN ALL PRINCIPAL CITIES**

FREE CATALOG



MAIL COUPON NOW

TITUS MANUFACTURING CORP., WATERLOO, IOWA

CHECK TYPE OF GRILLE ON WHICH SPECIAL INFORMATION IS DESIRED.

- ☐ Air Conditioning outlets
- ☐ Return air grilles and registers
- ☐ Volume controllers
- ☐ Door ventilators
- ☐ Special made-to-order grilles
- ☐ Send complete New Catalog

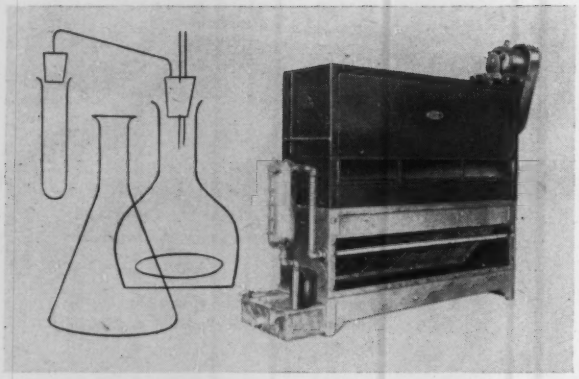
NAME _____

ADDRESS _____

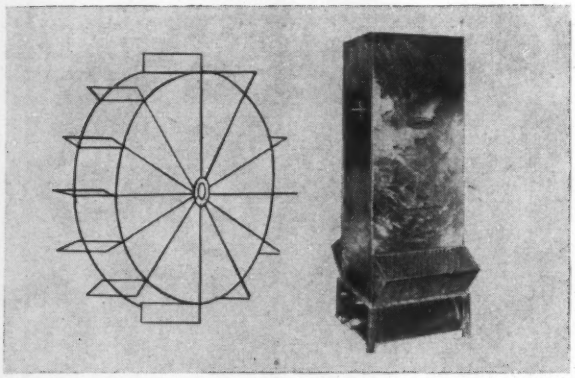
CITY _____ STATE _____

4 POINTS AND 8 EXAMPLES

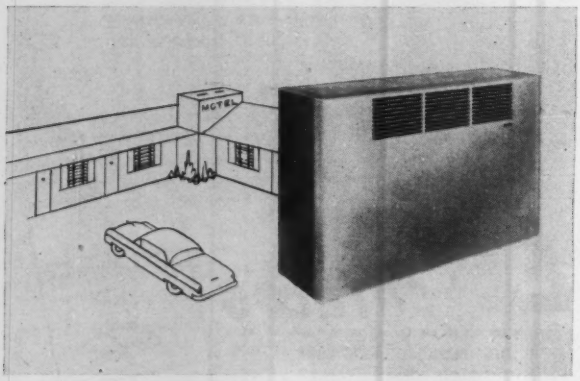
tell why you're better off with Carrier!



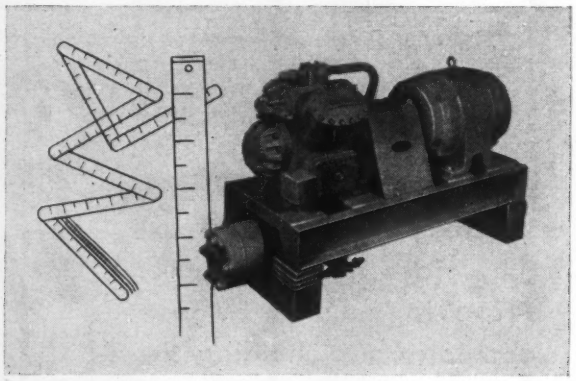
J-U-S-T RIGHT! When a customer needs close temperature and humidity control, check Carrier's versatile Industrial Weathermakers. They're used, for example, in a Dallas hospital, a Winston-Salem library, in many mills, banks, laboratories.



WATER-OPERATED COOLING TOWER has no fan motor and no electrical connections. A unique water turbine runs the fan. Requires no lubrication. Entire casing is hot dip galvanized *after* fabrication for long life. Capacities from 5 to 15 tons.

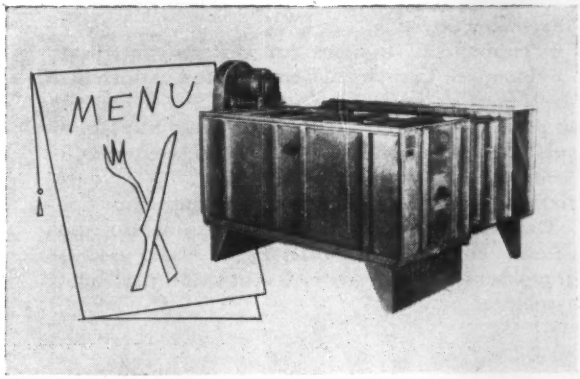


ALL THOSE ROOMS AND NO DUCTS. In small and middle-size buildings, Carrier Room Weathermakers serve up comfort neatly and economically. Fan-coil units fit under windows, use chilled and hot water (for year-round comfort) or direct expansion.

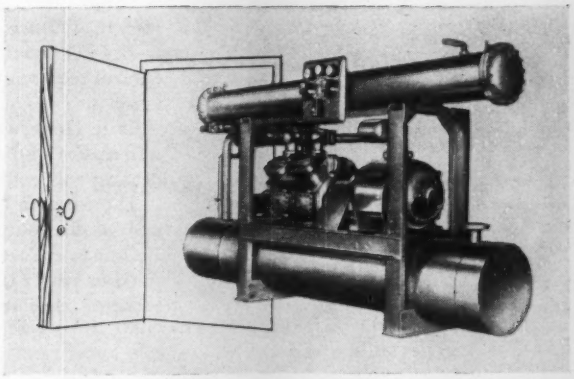


COMPRESSORS IN 18 SIZES. Adaptable Carrier Reciprocating Compressors cover the field, fit jobs *exactly* with peak efficiency and capacity. They range from 2 to 200 hp. Direct or belt drive. Replaceable wearing parts guarantee long service.

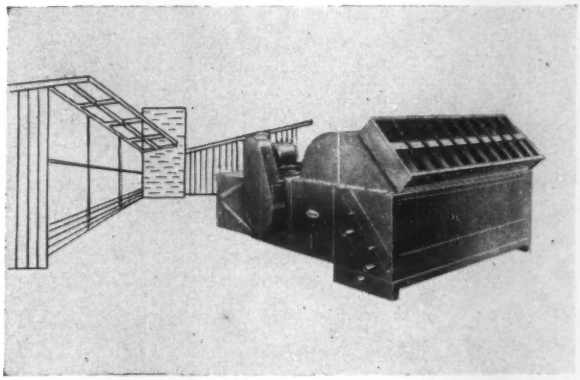
1. *The Carrier name is easiest to sell because customers know and respect it.*
2. *In the Carrier line-up there's the* right *equipment for every job you tackle.*
3. *The Carrier record of performance is your guarantee of the best possible results.*
4. *The Carrier technical team backs you up on every phase of the job.*



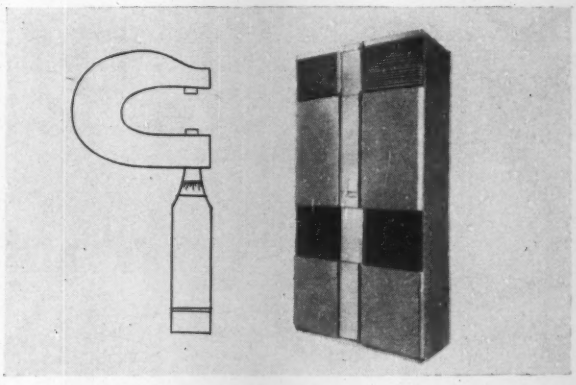
COMFORT A LA CARTE. How will you have your air? Cooled? Dehumidified? Heated? Humidified? Filtered? You can make up a Carrier fan-coil type System Weathermaker to fit any requirement. Typical installation: London House, Chicago.



FITS THROUGH A DOORWAY. Carrier's compact, completely assembled water-cooling system cuts installation problems to the bone. Reciprocating compressor is driven by a 75-hp motor. Can be used for all kinds of comfort and process applications.



ALL-AROUND COMFORT, regardless of quick changes in cooling loads, is easy to plan for with Carrier Zoning Weathermakers. You'll find them balancing comfort in office suites, radio-TV studios, department stores and multiple unit tourist courts.



PRECISION-ENGINEERING accounts for the extra quiet, extra dependable, extra long life of Carrier's packaged Weathermakers. Vital compressor parts are made from special alloy steels machined to microscopic tolerances. Six sizes—from 2 to 15 hp.

Carrier

AIR CONDITIONING • REFRIGERATION • INDUSTRIAL HEATING

Carrier Corporation, its distributors and dealers, stand ready and willing to work with you in any phase of air conditioning. Call your local Carrier distributor. Or write to Carrier Corporation, Syracuse, New York.

How Honeywell Customized Temperature Control can help you

Give your clients control of their own "indoor weather"

New home of the Daytona Beach Federal Savings and Loan Association, Daytona Beach, Florida. Architects and engineers: Bank Building and Equipment Corporation of America, St. Louis. Heating contractor: D. W. Browning Plumbing and Heating, Daytona Beach, Florida.

Why Honeywell Customized Temperature Control is becoming a building "must".

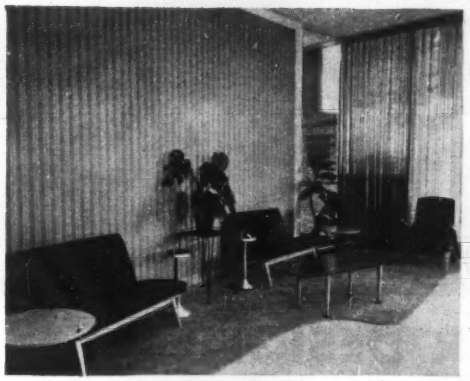
More and more, clients are becoming increasingly aware of how comfortable buildings help attract better personnel, help keep customers happy.

Today the best way to provide year around comfort is through the use of *Honeywell Customized Temperature Control.*

The key word here is "customized." It means that whatever your clients' control requirements, a Honeywell Customized Temperature Control installation *designed to fit the needs of the building and its occupants is your answer.*

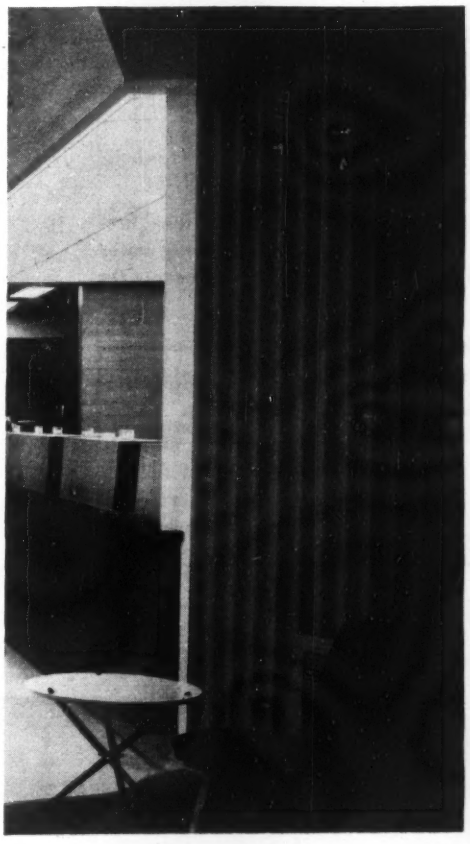
Only Honeywell can provide "customized" control. Because only Honeywell makes all three types of controls—pneumatic, electric and electronic, for heating and cooling, ventilating and humidity.

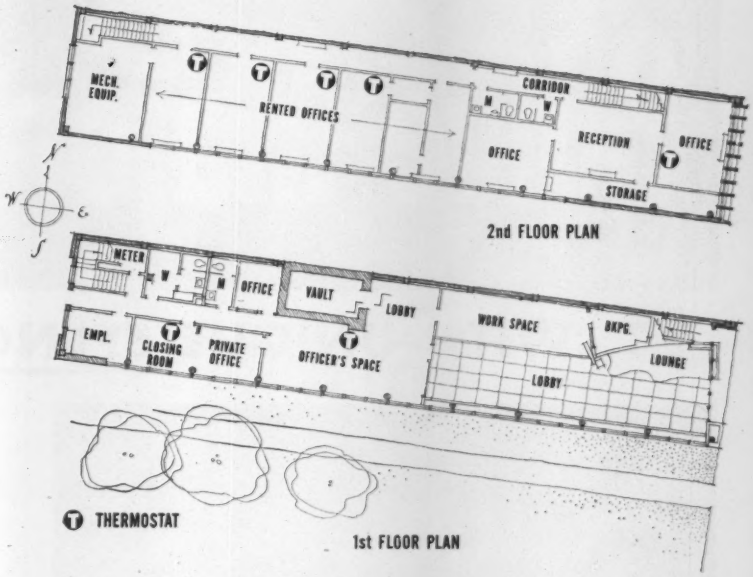
The story, in brief form, of the Honeywell Customized Temperature Control installation in the Daytona Beach Federal Savings and Loan Association Building in Daytona Beach, Florida, is told here. The *techniques* used, applied to your particular problems, can help you give your clients the "indoor weather" they've always wanted.



This reception room is typical of the modern design of the entire building. Modern design includes "indoor weather" control provided by Honeywell Customized Temperature Control. On the second floor, individual thermostats in each of the office spaces make it possible for tenants to maintain the "indoor weather" at the level *they* prefer.

Thermostats on the main floor guard against overheating by solar radiation through the large exposure of glass which faces south. Main floor thermostats of the Honeywell Customized Temperature Control installation do another job too: they give the proper degree of heating or cooling in the more enclosed spaces at the rear.





For comfortable, even temperature in new or existing buildings—of any size—use Honeywell Customized Temperature Control

WHETHER it's a bank, office, motel, airport, hospital, apartment, church, school, factory, store, garage—or any size building—new or existing, Honeywell Customized Temperature Control can help meet your clients' heating, ventilating, air conditioning and industrial control problems.

Your clients will not only enjoy more comfort and efficiency than they've ever known, they'll save fuel, too.

For full facts on Honeywell Customized Temperature Control, call your local Honeywell office. Or mail the coupon below.

L. E. Northrup, executive vice-president of the Daytona Beach Federal Savings and Loan Association, says:

"It is our belief that our new building offers the finest service and facilities for miles around. Important in helping us provide just that is our Honeywell Customized Temperature Control installation."

MINNEAPOLIS
Honeywell

104 OFFICES
ACROSS THE NATION

First in Controls

MINNEAPOLIS-HONEYWELL REGULATOR CO.
Dept. HA-2-31, Minneapolis 8, Minnesota
Gentlemen:
I'm interested in learning more about Honeywell Customized Temperature Control.

Name.....

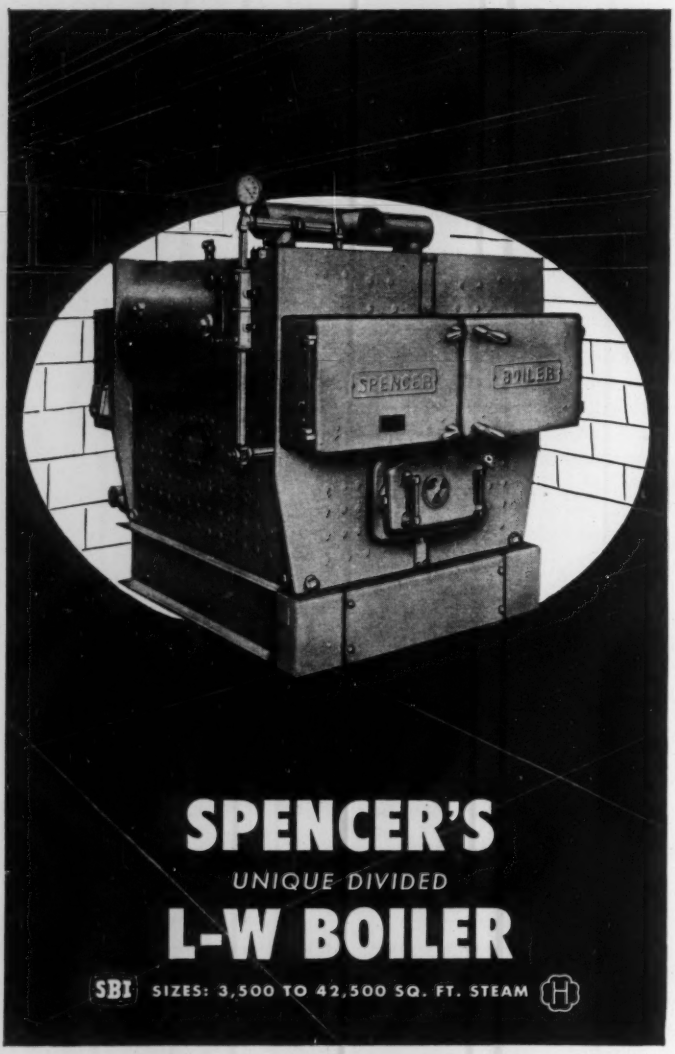
Firm Name.....

Address.....

City..... *Zone*..... *State*.....

Solve Major Heating

...WITH UNIQUE SPENCER DESIGNS!



PROBLEM #1
Installation of a large boiler in an existing building with narrow basement entrance.

SOLUTION:
Spencer's Divided L-W Boiler.
Divided in half, this boiler can be moved easily through narrow doorways. Though its two watertight sections can be moved in separately, they need no welding for installation.

PROBLEM #2
Boiler installation in new building where high excavation costs make low basement ceiling imperative.

SOLUTION:
Spencer's Divided L-W Boiler.
Nearly 25% lower than conventional firebox boilers, this boiler fits into lower ceilinged basements . . . saves costly excavation.

Other time-tested advantages of Spencer's L-W Boiler

It's self-cleaning. It's fast steaming due to special staggering of fire tubes. It can be quickly converted from hand to mechanical firing.

THERE IS A SPENCER FOR EVERY BUILDING...

Problems

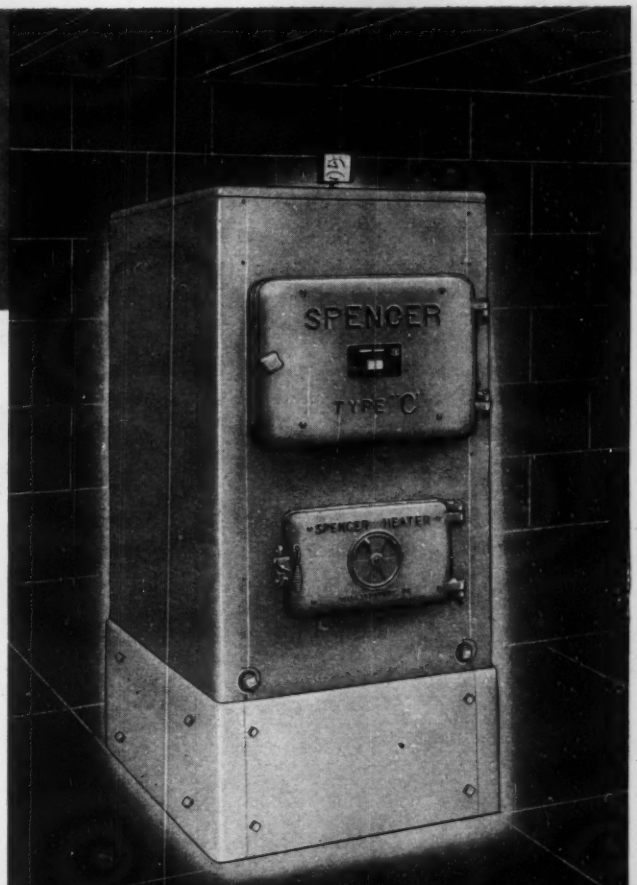
PROBLEM #3
For smaller installations, provide a dependable heating boiler at low cost!

SOLUTION:
Spencer's new "C" Boiler.
A commercial boiler that sells close to residential prices, Spencer's "C" Series is your answer to the cost problem. Similar in design to Spencer's heavy-duty commercial units, the new "C" contains two complete passes of fire tubes and is available with standard 15" base or extra base heights at nominal charge.

Other outstanding features of the "C" Boiler

Water-cooled precision-ground flue and fire-door frames, equipped with heavy cast-iron, insulated doors; extra-heavy steel-plate smokeboxes; staggered boiler tubes for rapid heat transfer.

For any heating problem—Spencer offers a complete line of heating boilers, for every building, for every fuel. For more information about Spencer products designed to give top performance on any job, use the coupon at right.



SPENCER "C" BOILERS

For Motels, Schools, Churches, Apartments
Commercial and Industrial Buildings
Capacity Range: 1100 to 5000 sq. ft. steam net rating
1760 to 8000 sq. ft. water net rating

For specifications and more information about Spencer's many lines of boilers:

CLIP AND MAIL

Spencer Heaters, Dept. HP-2-4
Lycoming Division
AVCO Manufacturing Corp.
Williamsport, Pennsylvania

Dear Sirs:
Please send me specifications and additional information on the boilers checked off below:

- ☐ Spencer's "C" Series
- ☐ Spencer's Divided L-W Series
- ☐ Spencer's Other Commercial Boiler Lines

Name_____
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SPENCER
HEATER
LYCOMING DIVISION
WILLIAMSPORT AVCO PENNSYLVANIA

FOR EVERY FUEL

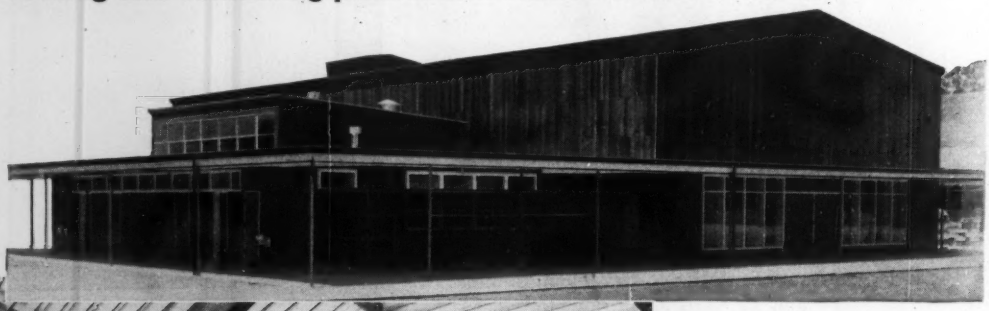
BARBER COLMAN

ELECTRIC

Control Center

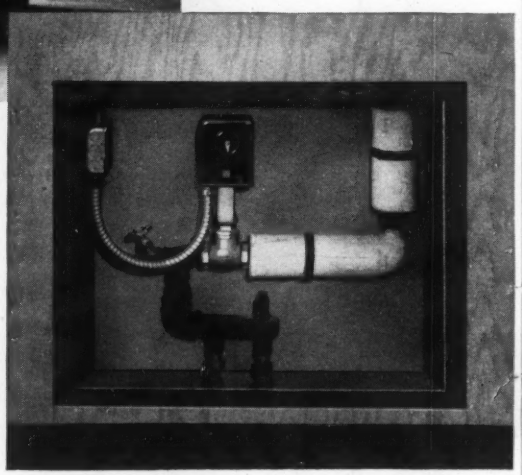
Modern electric control system provides low-cost solutions to heating and ventilating problems at TIERRA LINDA SCHOOL

Location: San Carlos, California. *Architect:* John Lyon Reid. *Consulting Engineer:* Dwight Coddington. *Heating Contractor:* Schlegel Plumbing Contractors, Inc.



As modern as the building design itself are the electric temperature control and air distribution systems installed in Tierra Linda Grade School. Atmospheric conditions are provided which contribute to the alertness of students and faculty, yet require minimum attention and expense. Each area having specialized requirements is individually engineered. Unitary control systems are readily accessible for checking . . . servicing of one unit does not require a shutdown of the complete system.

Auditorium is a multi-purpose room. Eight Barber-Colman Uni-Flo Diffusers discharge air downward along each outside wall. Eight return grilles are mounted along each wall near the center of the ceiling. Result: healthful, draft-free air distribution under all conditions.



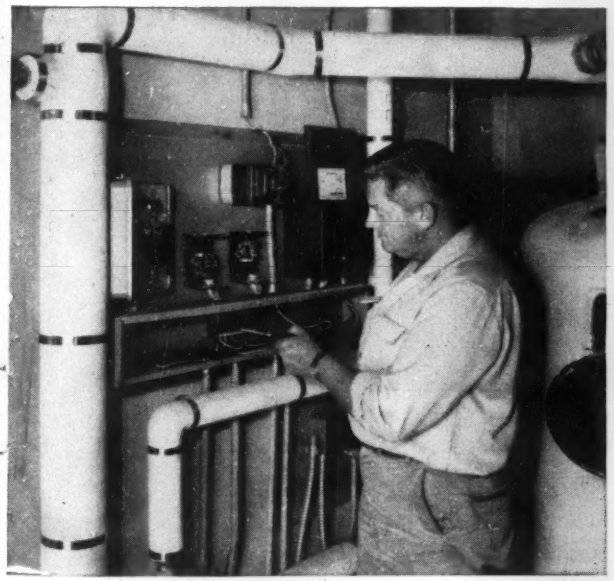
Room thermostats on walls control compact motor-operated valves installed in partitions of classrooms. Temperature of each room is controlled independently within close limits for comfort of occupants.

How an improved heating and ventilating system results from combined "know-how" on electric controls and air distribution products is exemplified in this excellent example of contemporary school housing. In an area of 39,106 square feet, seventh- and eighth-grade students are provided with eighteen classrooms, locker and shower rooms, music room, library, materials center, toilets, closets, a general-purpose room, and administrative offices.

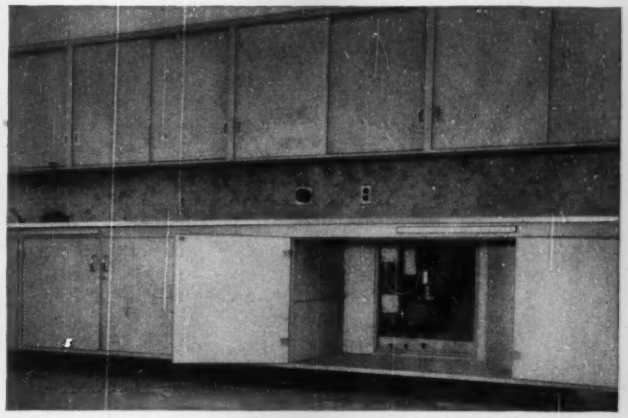
Classrooms and offices have radiant panel heating; the multi-purpose room has a separate ventilating system; the kitchen has unit heaters; the dining room, convectors. All areas are served by a central boiler plant.

Over-all benefits include: (1) automatic electric operation, requiring minimum attention from the custodian, yet permitting optional manual control; (2) a decrease in anticipated fuel and electric consumption; (3) low-cost installation in widely separated buildings; (4) satisfactory operation with low maintenance costs.

Pleasantly surprising to the architect, consulting engineer, and contractor were the lower installed costs for improved Barber-Colman electric control systems. Similar pleasant surprises are being experienced throughout the country as investigations reveal the many advantages of newest types of electrical controls for many types of buildings. For the complete story on modern control techniques, including the B-C "Control Center" method, phone nearby field office (consult classified directory) or send coupon below.



Big cost-saving factor was Barber-Colman technique of placing modern "Control Center" in boiler room. Here, at one central junction point, are prewired accessories and numbered terminal strips for connecting all electrical components of each unitary control system. Included here are proportioning-type, adjustable-ratio, outdoor reset controls actuating proportioning-type, motor-operated valves for supplying hot water to radiant heating system and controlling fan operation. Individual systems can be checked or revised at "Control Center" cabinet.



Utilization of space is visualized here by installation of unitary control components in recess behind wall cabinets. No floor space is used, yet electric controls are readily accessible.

One responsibility for automatic control and air distribution products pays off!

By engineering, manufacturing and supervising installation of *both* electric controls and air distribution equipment, Barber-Colman is in a unique position to solve problems for the heating, ventilating, and air conditioning industry. Centering of these responsibilities in one manufacturer avoids arguments, gives greater assurance of operating satisfaction, guarantees results!

BARBER COLMAN

ELECTRIC

Control Center

Automatic Controls • Air Distribution Products • Industrial Instruments
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☐ Send free copy of new booklet "How You Can Simplify Control Problems and Save Money with 'Control Centers'."

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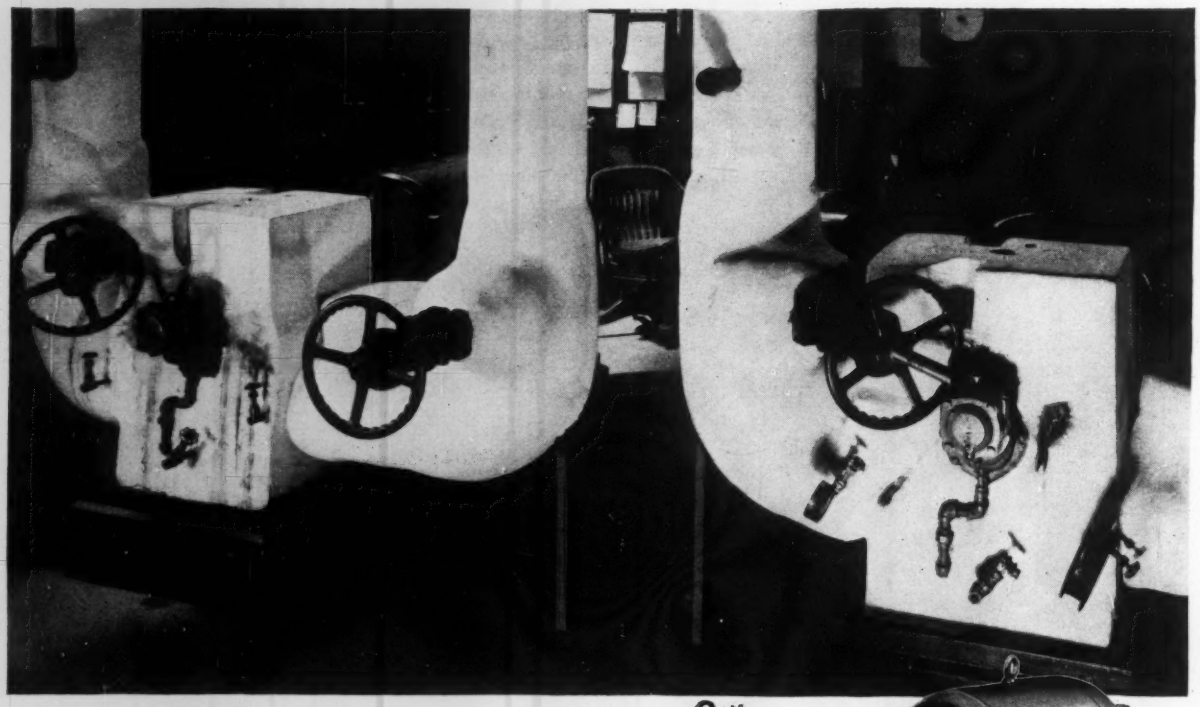
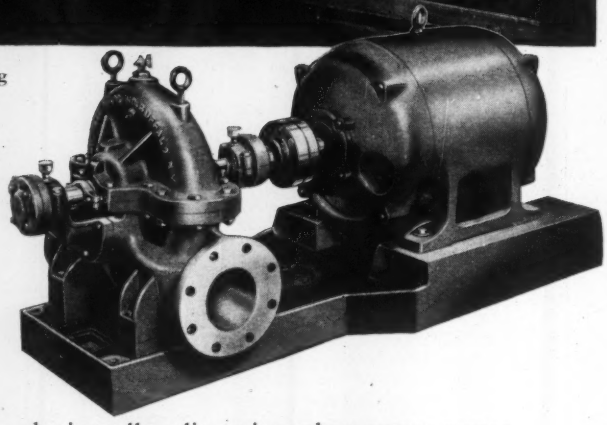
HANDLING CHILLED WATER EFFICIENTLY IN REFRIGERATION and AIR CONDITIONING



Two "Buffalo" Type "SL" Double Suction Pumps Handling Condenser Water In A Large Plant

"BUFFALO" DOUBLE SUCTION PUMPS

Since your installation can operate no more efficiently than its pumps, these should be specified as carefully as other key equipment. Will these pumps deliver the high volumes required? What about efficiency? Are they easily serviced? How well have these pumps stood up on similar jobs? Here are important questions that determine future satisfaction with the job . . . and "Buffalo" Type "SL" Pumps qualify on all counts. From their high-efficiency enclosed impellers to their rugged



horizontally split castings, these proven pumps embody the finest materials, engineering and workmanship to be had. Why not investigate? Write for Bulletin 955-P.

"Buffalo" PUMPS

BUFFALO PUMPS, INC.

171 Mortimer St. Buffalo, New York
Subsidiary of Buffalo Forge Company
Canada Pumps, Ltd., Kitchener, Ont.
Sales Representatives in all Principal Cities.

A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID

Expand your air-conditioning business with

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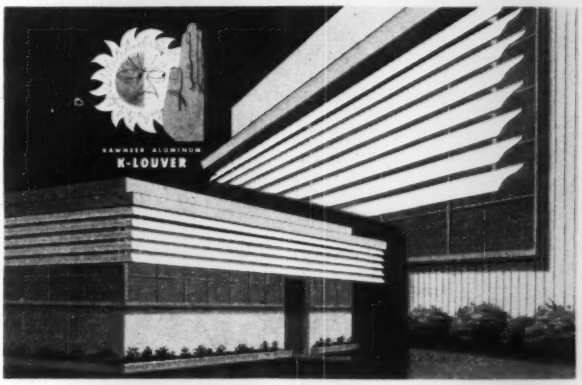
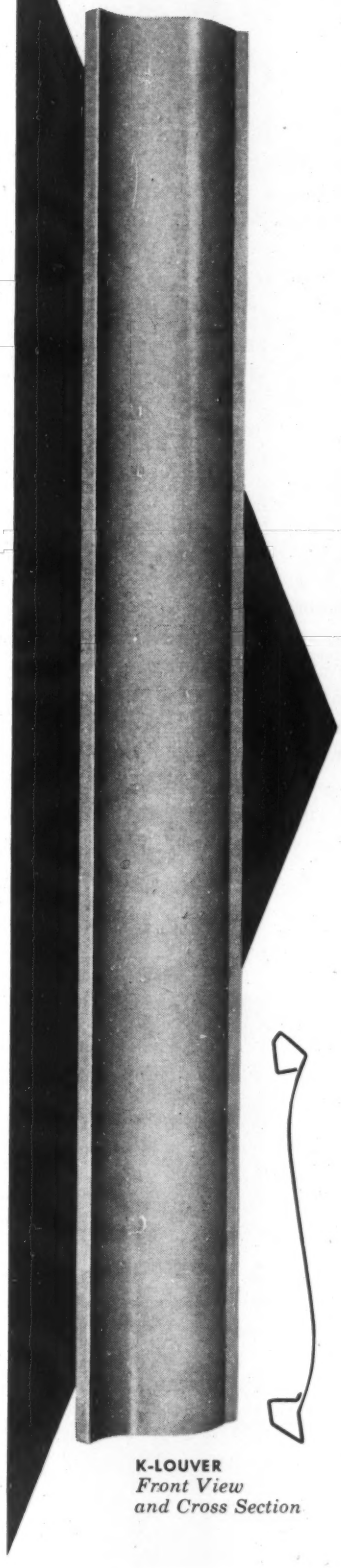
New, profitable sun control product by Kawneer

Permanent, "Built-in" louvers stop the sun heat load on windows



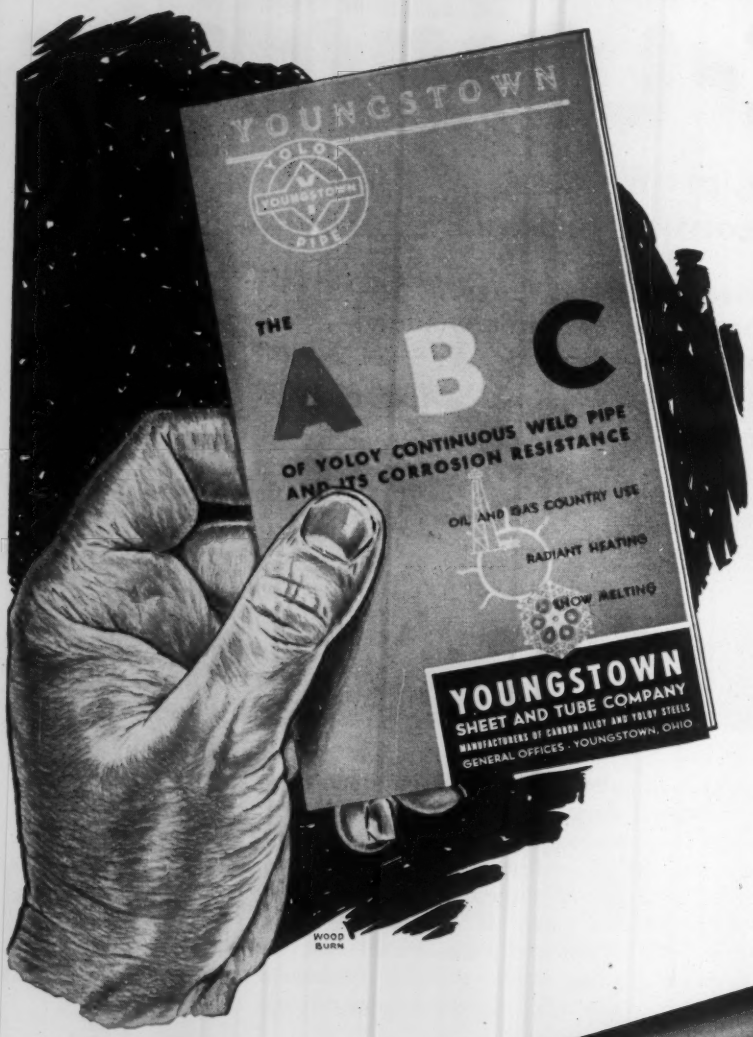


K-LOUVER
Front View and Cross Section

Aluminum K-Louvers offer an excellent opportunity for additional work and income. This amazing new product is designed to harmonize with architectural lines (the "Kawneer Touch"), to perform a highly efficient job of reducing the sun load on windows and control glare. It is presently being introduced to architects and engineers all over the country in the leading architectural publications and in person by the large Kawneer sales organization.

K-Louvers are a natural companion to air conditioning systems. They reduce operating and maintenance costs and in new installations cut the initial cost. Get into this profitable business now. Easy and quick on-the-job fabrication. Just write Kawneer, Niles, Michigan, to learn more about the K-Louver dealership.

This DATA may solve YOUR piping problem



● Here is the up-to-date story of Yoloy Continuous Weld Pipe—a remarkable low alloy steel whose nickel-copper content gives it unique ability to withstand corrosion, abrasion and shock. These outstanding advantages combined with high strength, ductility and weldability make Yoloy Pipe an excellent selection.

Proved by 18 years of satisfactory performance, Yoloy is highly recommended by users in such service as radiant heating, snow melting, gas line gathering, brine lines and other industrial piping.

This new folder presents the facts and figures on Yoloy's physical and chemical properties, with data on sizes now available and other information you'll need to select Yoloy Continuous Weld Pipe to meet your special requirements. Write for a copy today.

THE YOUNGSTOWN SHEET AND TUBE COMPANY

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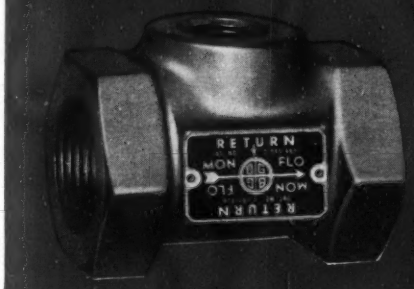
COLD FINISHED CARBON AND ALLOY BARS - ELECTROLYTIC TIN PLATE - COKE TIN PLATE - WIRE - PIPE AND TUBULAR PRODUCTS - CONDUIT - RODS - SHEETS - PLATES - BARS - RAILROAD TRACK SPIKES.

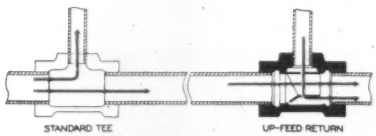
POTTERY PLANT CUTS DRYING COST AND WASTE WITH B&G MONOFLO SYSTEM



B & G MONOFLO FITTINGS ASSURE CORRECT AND EFFICIENT CIRCULATION IN ONE-PIPE FORCED HOT WATER SYSTEMS

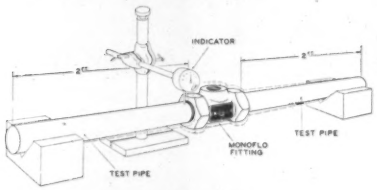
The B & G Monoflo Fitting is not just a "scoop" or "choke"! It is an *engineered* device—designed to handle definite radiator sizes, maintain proper temperature drops and permit use of economical riser sizes.

This Fitting induces flow into the heating units without penalizing the pump with excessive resistance. It assures the correct distribution of warm water, either above or below the main.



ONLY ONE MONOFLO FITTING NEEDED IN MOST CASES

Under average conditions, a single Monoflo Fitting per heating unit provides ample diversion capacity. Special down-feed Fittings are not required—simply revolving the Fitting changes it from up-feed to down-feed.



PRECISION TAPPED AND TESTED

B & G Monoflo Fittings are made by machines especially designed for the purpose, which tap the threads with extreme precision. Fittings are tested for accuracy in the sensitive gauge illustrated above. Hence installation is always easy, with no "cranking" of pipes.

In the pottery plant drying room illustrated above, a B & G Monoflo Forced Hot Water System is overcoming many former operating difficulties.

The previous method of drying the pottery was a rather complicated system of ducts carrying heat under the racks. The process was difficult to control, expensive to operate and caused a large number of rejects.

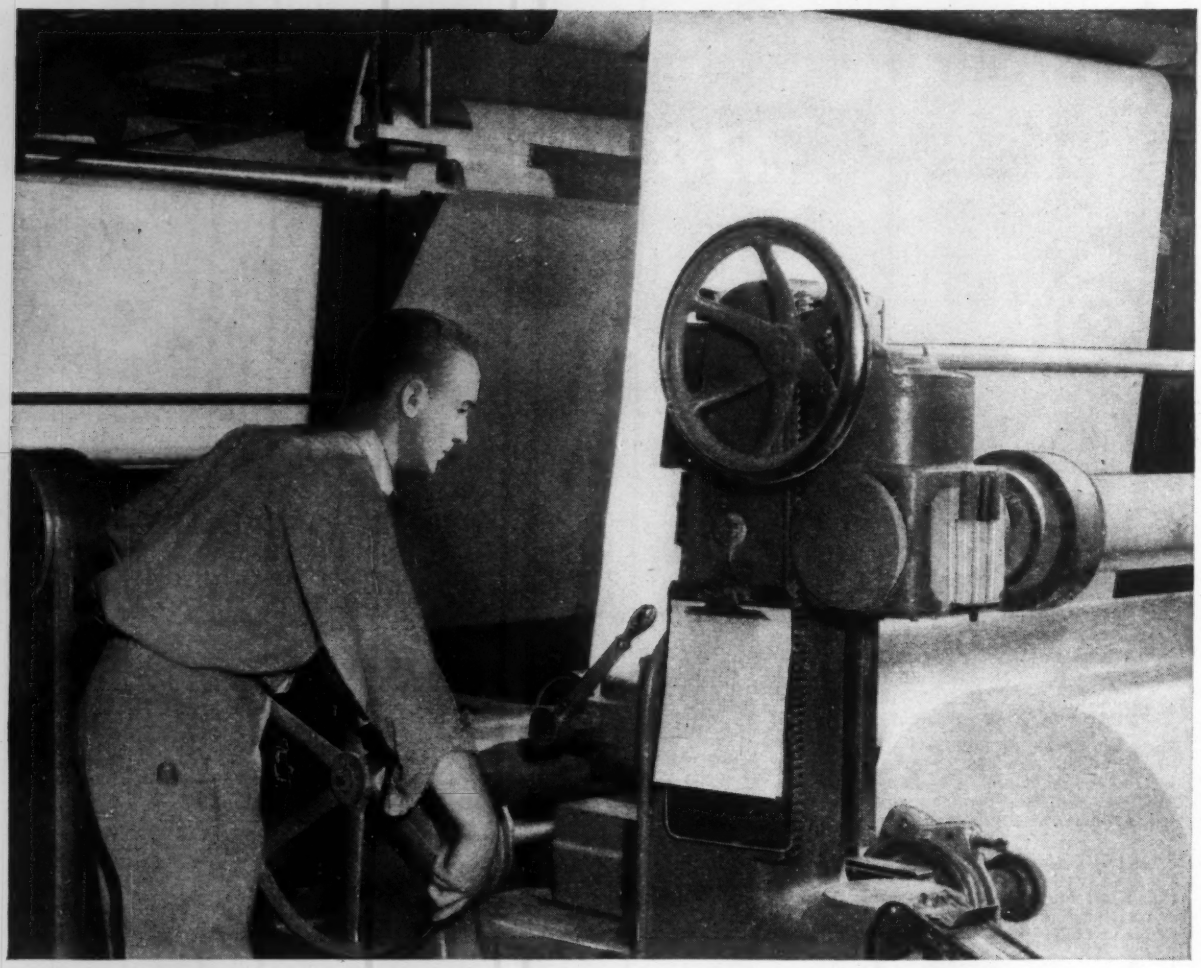
In the new method, a down-feed Monoflo System supplies heat to pipe coils under the pottery. After a year's operation, the management reports that the system is doing everything expected of it and more. The number of rejects has been drastically reduced, operating cost is lower and the process control greatly improved.

The simplicity of Monoflo piping and the desirable control qualities of the system are amply demonstrated in this novel installation.

Send for complete story of B & G Monoflo Fittings

Contains simplified design instructions for Monoflo Forced Hot Water Heating Systems in smaller installations.

BELL & GOSSETT
COMPANY
Dept. DH-5, Morton Grove, Ill.
Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Drive, Toronto, Canada



A hot air blanket halts penetration at the critical point.

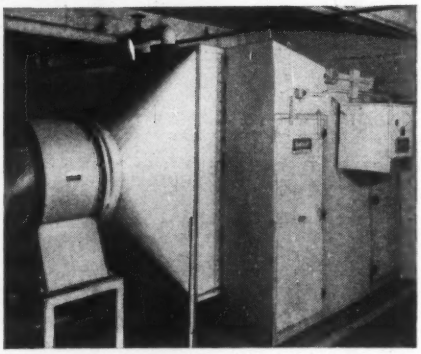
Turning Heat On "Big Bertha"

GUARANTEES PAPER QUALITY, SPEEDS PRODUCTION

Coating Diazo duplicating paper is tricky business. Special sensitizing solutions must penetrate it—but only to an exact, pre-determined depth. "Big Bertha", the world's largest drier, is Ozalid's answer. In six temperature control zones, a hot air blanket halts penetration at the critical point, keeps a constant moisture content in the 975 feet of paper processed every minute.

To assure positive control, J. O. Ross Engineering Corp. specified Westinghouse fans for this drier. Teamed up with PRECIPITRON®, the electronic air cleaner, they handle 95,500 cfm of dirt-free, high-temperature air twenty-four hours a day. Rugged, dependable Silentvane® Fans need little maintenance, give long service at low operating cost.

Westinghouse offers a complete line of air handling, air conditioning and air cleaning equipment. We can help you *put air to work*, too. Call your local Westinghouse-Sturtevant office. Westinghouse Electric Corporation, Sturtevant Division, Hyde Park, Boston 36, Massachusetts.



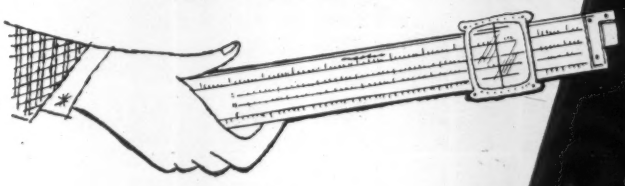
Paper quality must also be protected from harmful airborne dirt. So Westinghouse PRECIPITRON, the most efficient commercial air cleaner available today, is used. Seven of these units remove even the tiniest particles from the air by electronic attraction.

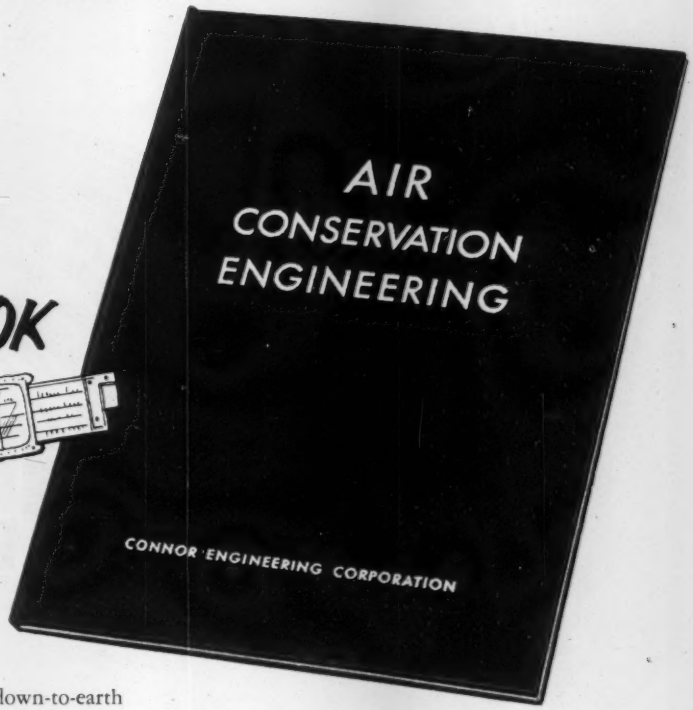
WESTINGHOUSE AIR HANDLING

YOU CAN BE SURE... IF IT'S **Westinghouse** J-80323

"I couldn't get along without it!"

NEW EDITION OF THIS FAMOUS HANDBOOK





Written out of 20 years of experience, this new edition of "Air Conservation Engineering" offers a wealth of factual information—latest theory as well as practical down-to-earth suggestions in this important field of engineering. A publication of Connor Engineering Corporation.

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- Activated Carbon and its Application
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air recovery

Written by Henry Sleik and Amos Turk, Ph.D., the book has a handsome sturdy binding, 76 pages, 8½" x 11", profusely illustrated. Price only $5.00 postpaid. Mail your check with coupon below.

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NOTE TO LIBRARIANS: Copies of "Air Conservation Engineering" are available, *without charge*, to accredited technical libraries. Write us on your letterhead.

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Enclosed is check for $..... Please send postpaid .....copies of the new edition of "Air Conservation Engineering."

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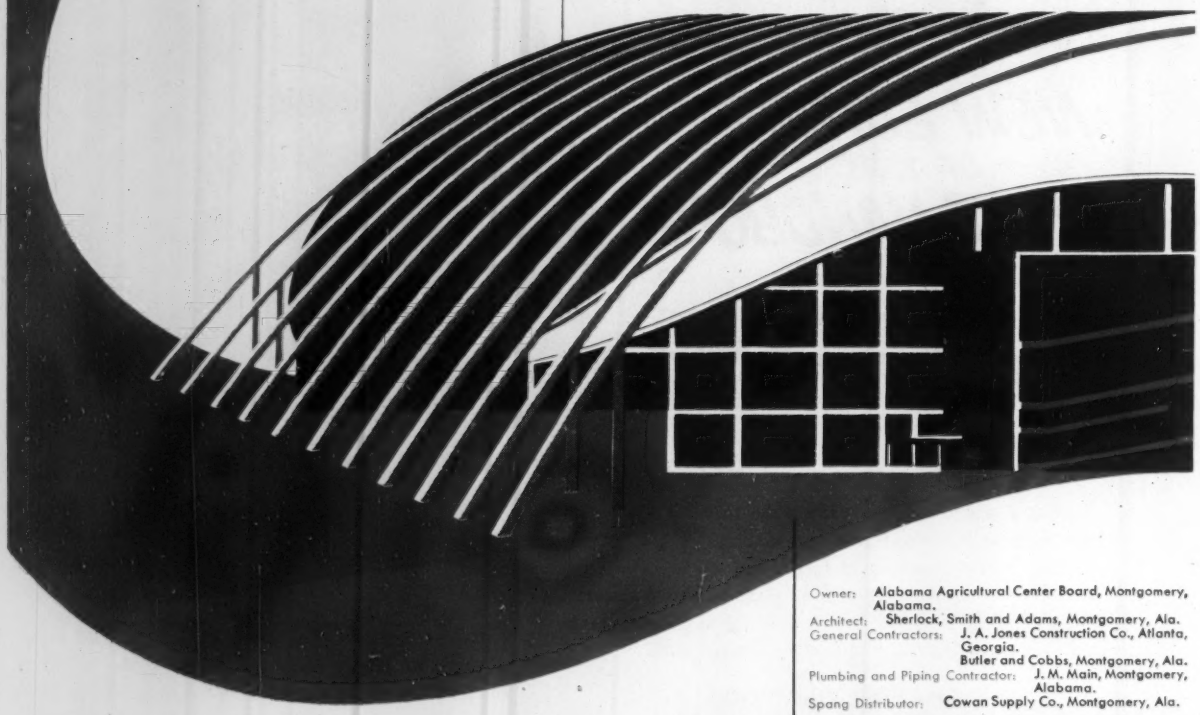
"CW" STEEL PIPE meets the exacting needs for Alabama's giant state coliseum



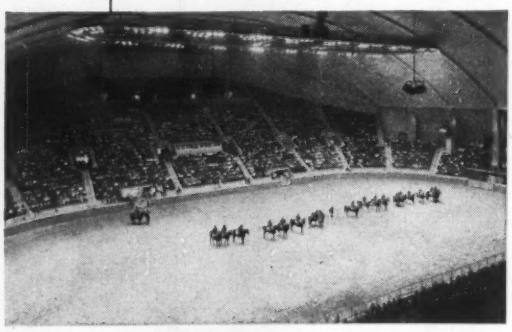
Owner: Alabama Agricultural Center Board, Montgomery, Alabama.
Architect: Sherlock, Smith and Adams, Montgomery, Ala.
General Contractors: J. A. Jones Construction Co., Atlanta, Georgia.
Butler and Cobbs, Montgomery, Ala.
Plumbing and Piping Contractor: J. M. Main, Montgomery, Alabama.
Spang Distributor: Cowan Supply Co., Montgomery, Ala.

Curving from the ground like the back of a huge turtle, the Alabama State Coliseum is the largest enclosed arena in the world. In order to build this enormous structure, which seats 15,000 and actually "grows" as much as two inches on a warm day, materials had to be selected which would meet the architect's and contractor's exacting requirements.

Spang CW Steel Pipe was chosen for this unusual project to insure a high-quality, reliable installation. The coliseum, which requires 9,800,000 Btu to heat when it's empty yet needs a cooling system in operation when it's crowded, uses Spang Pipe throughout for its gas lines, water lines and fire mains.

Architects and contractors who demand highest quality products always know they can specify Spang CW Steel Pipe with confidence. That's because the manufacture of Spang CW Steel Pipe is quality-controlled. Every phase of Spang CW Pipe manufacturing is subject to strict inspection, with close temperature limits rigidly adhered to, and only top-grade steel going into the product.

When you specify pipe, specify quality . . . specify Spang CW Steel Pipe.



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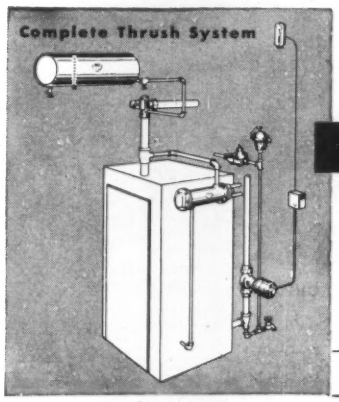

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Your built-in Vacuum Breaker feature of Thrush Pressure Tanks sounds valuable to us. Please send literature describing it.

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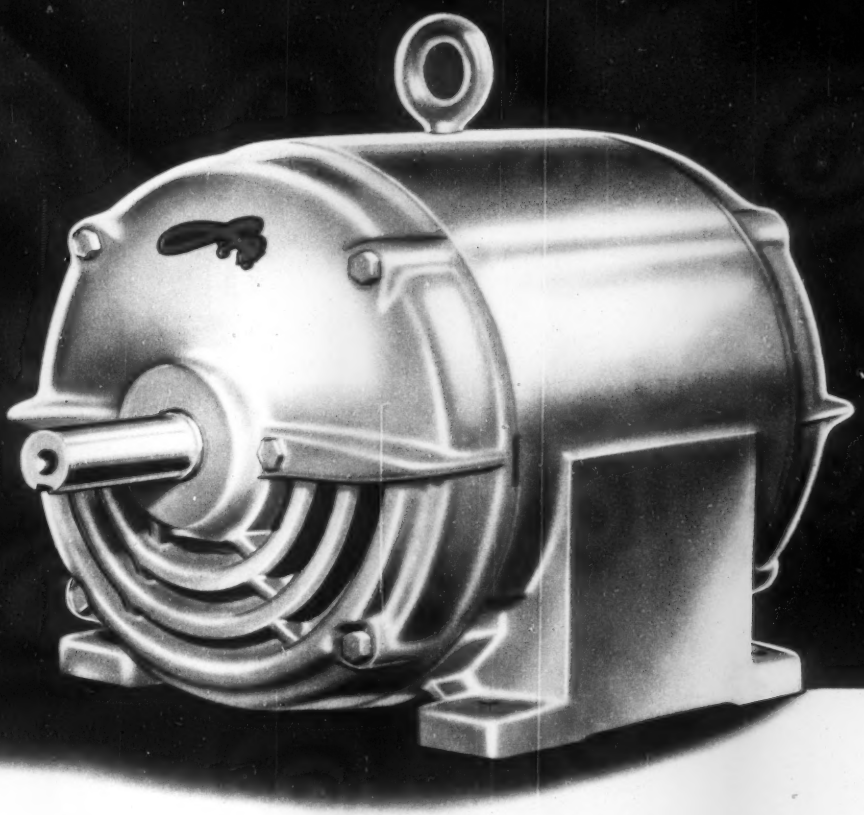
Not just a "face-lifting" to meet the new NEMA standards,
but a completely redesigned motor line

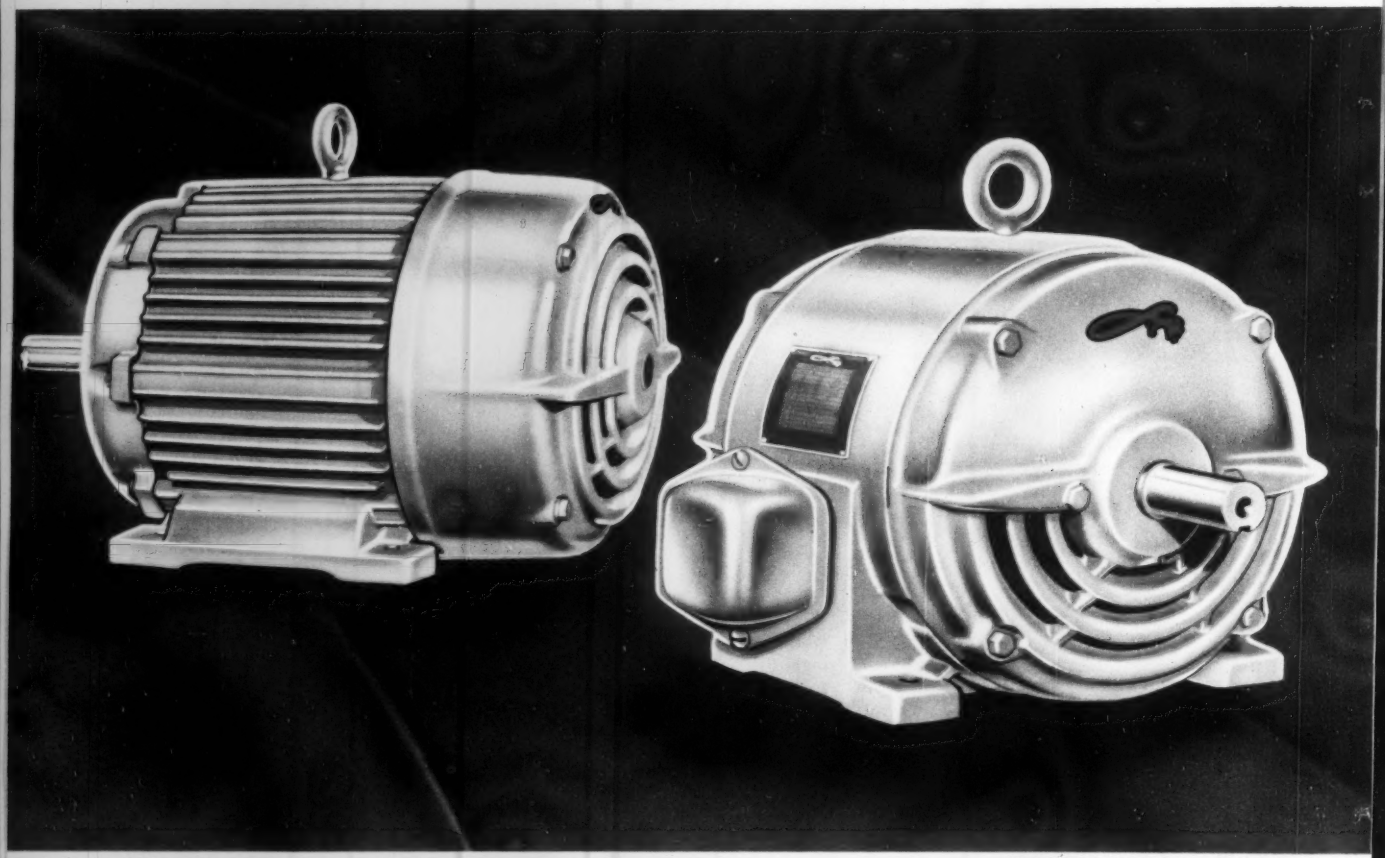
The Louis Allis Co. proudly presents the NEW L.A. *Line of electric motors*



. . . the concentrated utilization of over 50 years of engineering and development brings you this new concept in motors.

Please turn the page . . .

Here's new power for all standard and special motor applications



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▲ New L. A. Open Drip-proof Motor

From over 50 years of motor building experience and

many famous firsts including

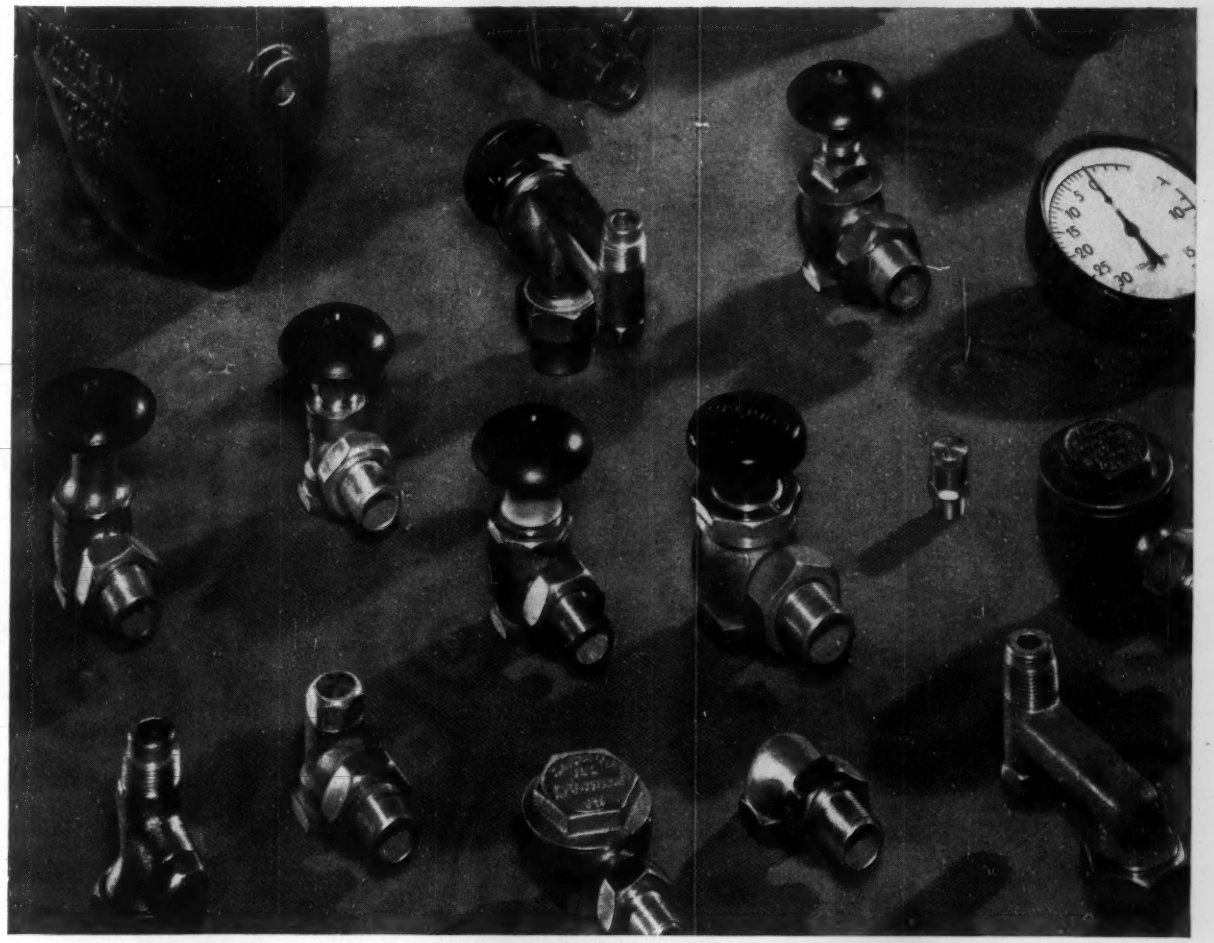
the first fan-cooled, explosion-proof motor
the first rapid-reversing motor
the first really splash-proof motor
the first screenless textile motor

comes the NEW *Line*

Here's the motor that's entirely new through and through, with such features as new modern styling... improved ventilation ...greater protection... new conduit box arrangement ...new bearing construction... and more versatile mounting. Get the facts on the most up-to-date motors available—the new L.A. line. See how these new motors can provide more power in a smaller package for your product or plant ...with the same high standards of Louis Allis performance, temperature ratings, service factors and torques. Call your Louis Allis Sales Engineer for the complete story.

Special Note *Louis Allis motors, built to the same high standards of quality and performance in the old NEMA standard frame sizes, will still be available if you require them for interchangeability or replacement.*

THE LOUIS ALLIS CO. · MILWAUKEE 7, WISCONSIN



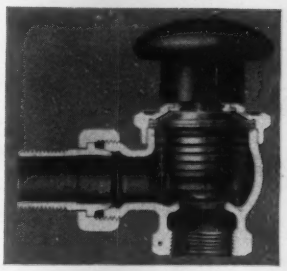
IT'S PROBABLY RIGHT ON THIS PAGE...

Every Steam Heating Specialty You Need is probably in the Dunham line, represented in the photo above. After all, Dunham's Specialties line is as complete as you'll find . . . *anywhere.* Every item has design features that mean better heating performance.

Dunham Packless Valves for example, do not have springs, packing or stuffing boxes. These *truly* packless valves cannot clog or corrode, since steam, water and dirt cannot come in contact with the valve spindle. As a result, the valve handle moves freely at all times—*and fully opens and closes in less than one turn.*

Dunham Packless Valves are constructed from precision-machined, all-brass castings and carry an indicating dial. Available in 4 body patterns and in 5 sizes.

For all the facts about Dunham's *complete* line of Heating Specialties, just clip and mail the coupon.



Dunham No. 1140 Packless Radiator Valve; 4 patterns, 5 sizes from ½-in. to 1½-in.

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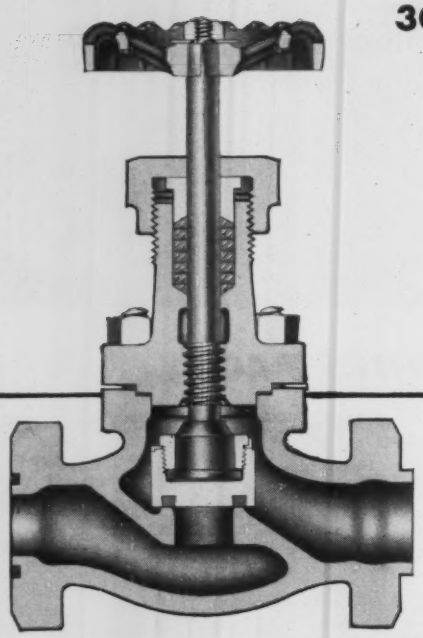
CRANE

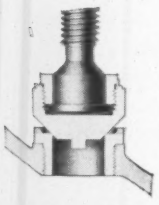
300-pound heavy-duty all-iron valves

Put these Crane valves to the test—use them for ammonia, air, oil, gas, caustic solutions, chlorinated compounds, alcohols—for chemicals and process work. Their rugged bodies of Ferrosteel (35% stronger than cast iron) . . . their precision seating designs . . . the unusually deep stuffing box and high-grade packing . . . the sweeping interior body contours . . . assure the safety and lasting service you want.

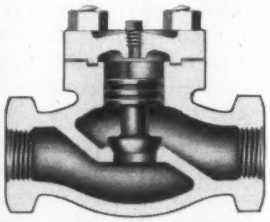
The line includes *bolted bonnet* globes and angles with choice of disc, *union bonnet* globes and angles with plug-type disc, lift checks, expansion valves, relief valves, liquid gauges—and all the fittings, flanges, return bends and other specialties for a complete Crane Quality installation. Check with your Crane man.



Cross-section bolted bonnet Globe, with flanged ends and special lead-faced disc. Sizes ¼ to 4-inch.



Bolted bonnet Globes also available with steel disc and seat where high temperatures or corrosion prohibit use of lead.



Cross-section, Lift Check with bolted cap, and cushioned disc action which increases valve life. Sizes ½ to 2-inch.

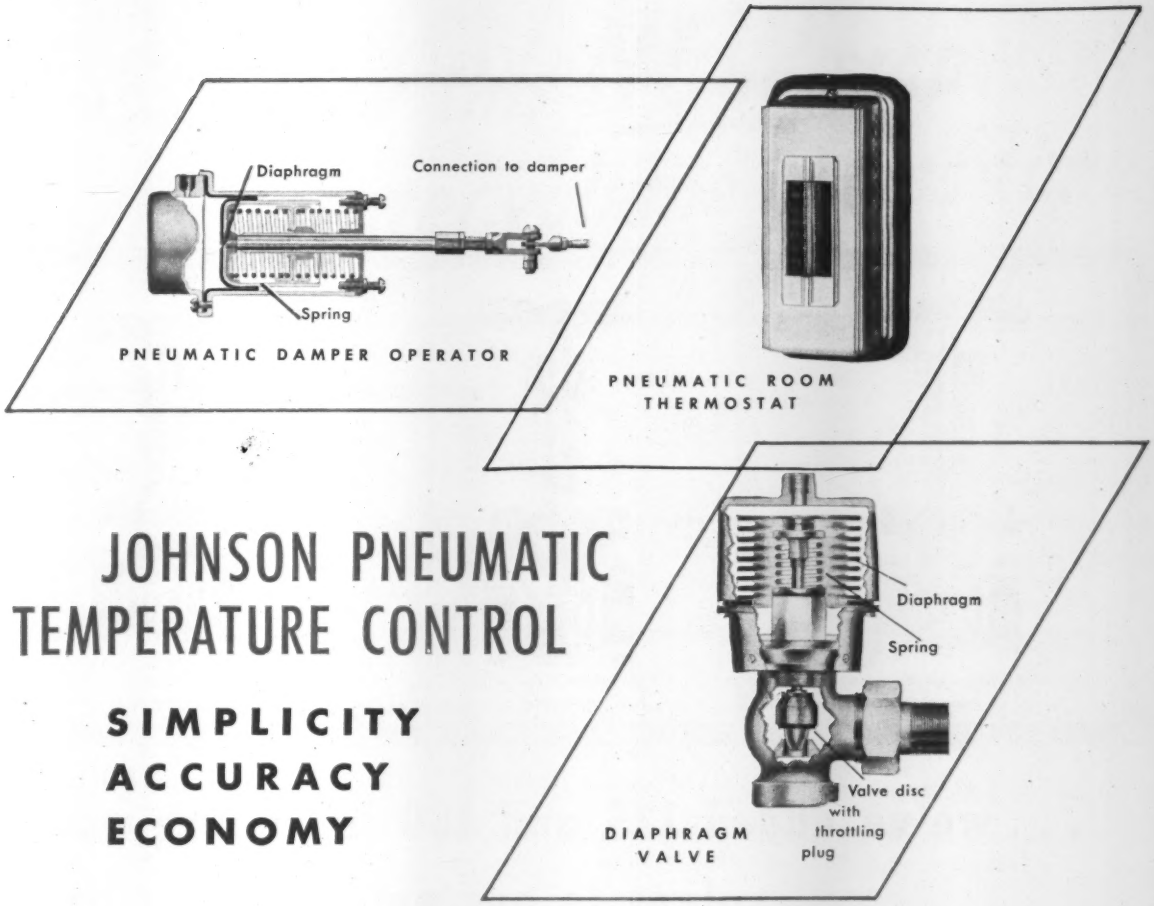
New 6-page folder AD1977 catalogs this complete Crane line. Write direct, or ask your Crane Representative.

THE BETTER QUALITY . . . BIGGER VALUE LINE . . . IN BRASS, STEEL, IRON

CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING



JOHNSON PNEUMATIC TEMPERATURE CONTROL

SIMPLICITY
ACCURACY
ECONOMY

Pneumatic power—compressed air—is simplicity itself, adaptable, dependable, economical . . . . In the automatic regulation of temperatures and humidities, for example, Johnson *Pneumatic* Control has been the standard since the '80's.

Each Johnson controller is merely a reducing valve in a compressed air line, set and reset automatically by an accurate temperature or humidity measuring element, to transmit compressed air, at varying pressures, to the valves and dampers which it controls. Johnson Diaphragm Valves and Damper Operators, too, are simple devices, with flexible, long-life diaphragms which are inflated as the controllers transmit increased air pressure.

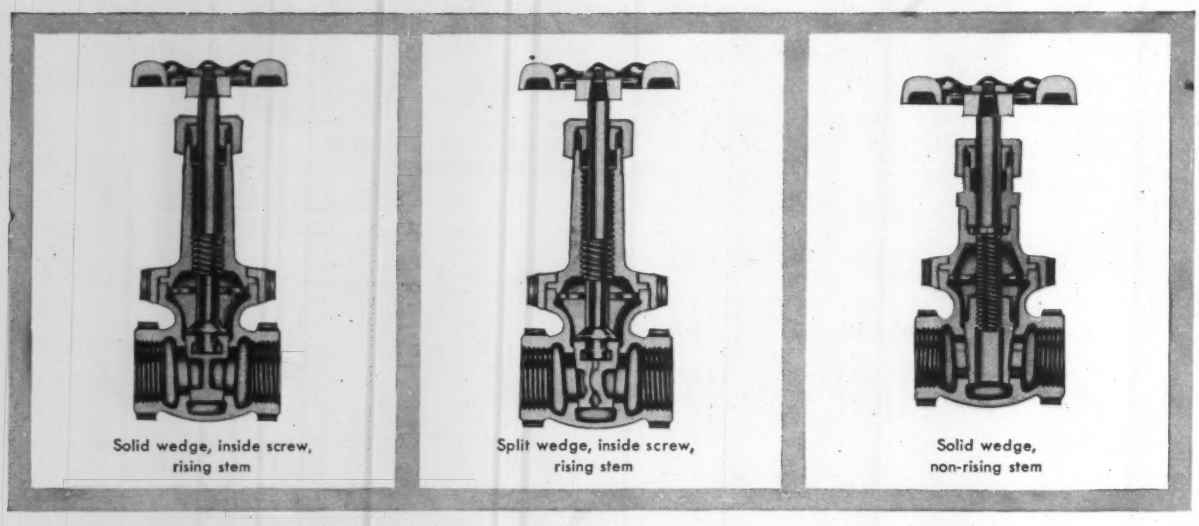
There are no mysteries here. And no complications! The operating cost of Johnson pneumatic equipment is very low—the only expense being the operation of a small compressor to supply air pressure. Where special conditions make it desirable, Johnson furnishes other types of apparatus, such as electronic temperature and humidity controllers, to operate either pneumatic or electric operators.

Attesting to the accuracy, dependability and adaptability of pneumatic control are thousands of Johnson Automatic Temperature Control Systems in textile mills, chemical and food processing plants, schools, hospitals, hotels, shopping centers, airports, office buildings, apartments, and many other types of buildings. The next time you have a temperature control problem, an experienced engineer from a nearby Johnson branch office will gladly prove to you how it can be solved most efficiently by Johnson *Pneumatic* Control. Johnson Service Company, Milwaukee 2, Wisconsin. Direct Branch Offices in Principal Cities.

JOHNSON · *Automatic Temperature and Air Conditioning* **CONTROL**

MANUFACTURING • PLANNING • INSTALLING • SINCE 1885

Oh, I see

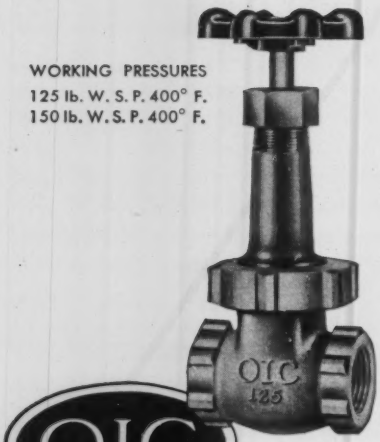


Solid wedge, inside screw, rising stem

Split wedge, inside screw, rising stem

Solid wedge, non-rising stem

. . . we've added 125 and 150 lb. bronze gate valves to our union bonnet line



WORKING PRESSURES
125 lb. W. S. P. 400° F.
150 lb. W. S. P. 400° F.

Success of our 200 lb. line of union bonnet bronze gate valves necessitates expansion of the line to include 125 lb. and 150 lb. classes. Sizes range from ¼ to 2 inches.

NOTE THESE ENGINEERING FEATURES:

This line has a flat seat on the bonnet which mates against the body, providing adequate bearing area for sealing.

Tight bonnet joint, but easy access to interior for inspection and service.

Full ports permit unobstructed flow.

Back-seating arrangement permits repacking while under pressure.

Split wedge has ball in socket contact . . . permits wedge to adjust itself to seat.

Slip-on type "T" head stem-to-wedge connection.

Lug-type hexes make valves compact and provide a better wrench-gripping surface.

To learn more about this expanding line of valves, write for our *Union Bonnet Bronze Gate Valve Catalog Folder.*

THE OHIO INJECTOR COMPANY • WADSWORTH, OHIO

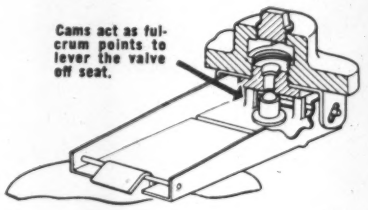
OIC
FOUNDED 1883

VALVES | **FORGED & CAST STEEL, LUBRICATED PLUG, BRONZE & IRON**

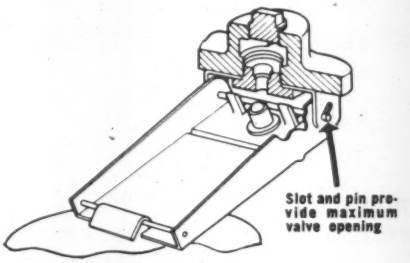
See how this NEW trap handles greater volume in less time

Yet it's small—gives you maximum capacity per dollar cost

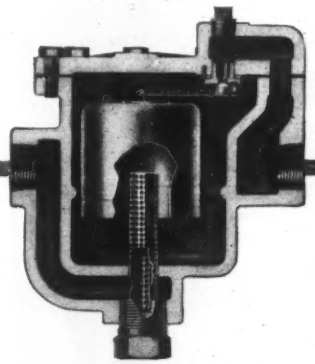
NEW SARCO
INVERTED BUCKET TRAP
with CAMLIFT valve mechanism

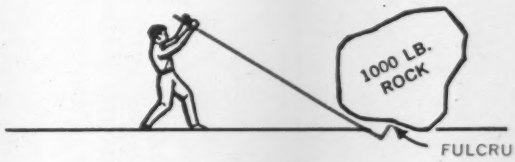


As bucket sinks CAMLIFT mechanism provides the powerful crowbar action needed to open large valve against steam pressure.

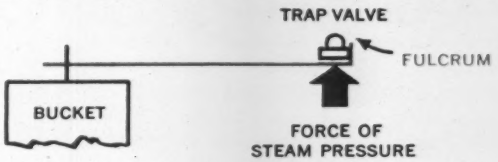


When steam pressure is overcome CAMLIFT mechanism drops to limit of slot, allowing rapid and free discharge of condensate.





MAN WITH CROWBAR MOVES 5 TIMES HIS WEIGHT



TRAP WITH *CAMLIFT* MECHANISM OPENS LARGE VALVE AGAINST MAXIMUM OPERATING PRESSURES

SARCO takes the principle of the fulcrum, incorporates it in its newly designed trap and gives you greater discharge with *no increase in trap size*. That means you get more for your steam trap dollar.

The Sarco *Camlift* valve mechanism makes this possible. It provides the powerful force needed to open the unusually large valve without a corresponding increase in trap size.

If you need a trap that's also rugged and simple in design, then we suggest you try this new Sarco Inverted Bucket Trap – in fact, we'd like to send you one for a free trial. We're confident you'll be convinced. Just clip the coupon and mail it in.

SARCO COMPANY, INC., Empire State Bldg., New York 1, N.Y.
Sarco Canada Ltd., Toronto 8, Ont.
Represented in Principal Cities

MAIL THIS COUPON TODAY FOR FREE TRIAL

Put this new inverted bucket trap to the test—see for yourself how to get more for your trap dollar.

Sarco Company, Inc., Empire State Bldg., New York 1, N.Y.

Gentlemen: Please send me a ½" Sarco Type B Bucket Trap for free trial. Maximum working pressure_____ psi; capacity_____ lbs/hr condensate.

NAME_____ TITLE_____

FIRM_____

ADDRESS_____

CITY_____ STATE_____

STEAM TRAPS • TEMPERATURE CONTROLS • STRAINERS • HEATING SPECIALTIES

"AUTOMATIC CONTROLS CUT OUR COAL BILL 20%!

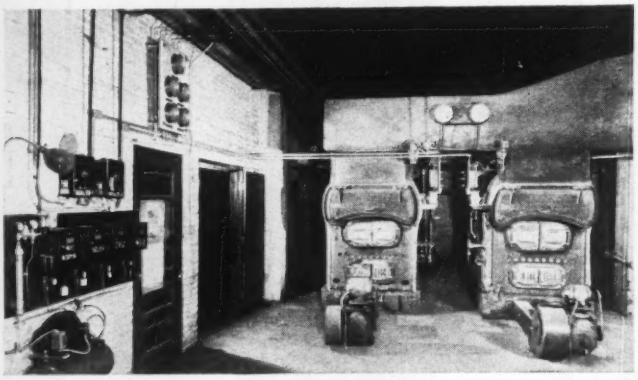
"We gave our modern coal-heating installation an additional boost in efficiency with automatic controls . . . saved $600 the first season,"

says R. C. Smith, Manager
Northern Finance Company, Northern Building
Green Bay, Wisconsin

Located in the heart of the city, Northern Finance Company's coal-heated building meets strict smoke control regulations. Burned properly, coal is clean and convenient.

"Up-to-date coal equipment has long supplied our building with dependable, *economical* heat. But a small additional investment in new automatic draft and building zone controls brought us even bigger savings. We cut fuel costs $550 to $600 a year."

Additional case histories, showing how other types of plants have saved money by burning bituminous coal with modern equipment, are available upon request.



The stoker-fed boilers and newly installed control panel used in heating this modern office building. Approximately 285 tons of coal are used annually.

How modern coal equipment can save you dollars

If your plant is more than a few years old, you can probably boost its efficiency and save money with modern combustion equipment. For example, a small investment in automatic combustion controls, or an efficient forced draft system, may bring you big savings in both fuel and labor.

And if your plant is over 10 years old, chances are you can make an even bigger saving. You can save up to 40% on fuel alone by installing modern combustion equipment. You can reduce labor costs substantially with modern coal- and ash-handling equipment.

Call in a consulting engineer. He can give you advice on just what equipment can best fill your specific needs . . . and return you big savings year after year with coal.

BITUMINOUS COAL INSTITUTE
A Department of National Coal Association
Southern Building, Washington 5, D. C.

If you operate a steam plant, you can't afford to ignore these facts!

BITUMINOUS COAL in most places is today's lowest-cost fuel, and coal reserves in America are adequate for hundreds of years to come.

COAL production in the U.S.A. is highly mechanized and by far the most efficient in the world.

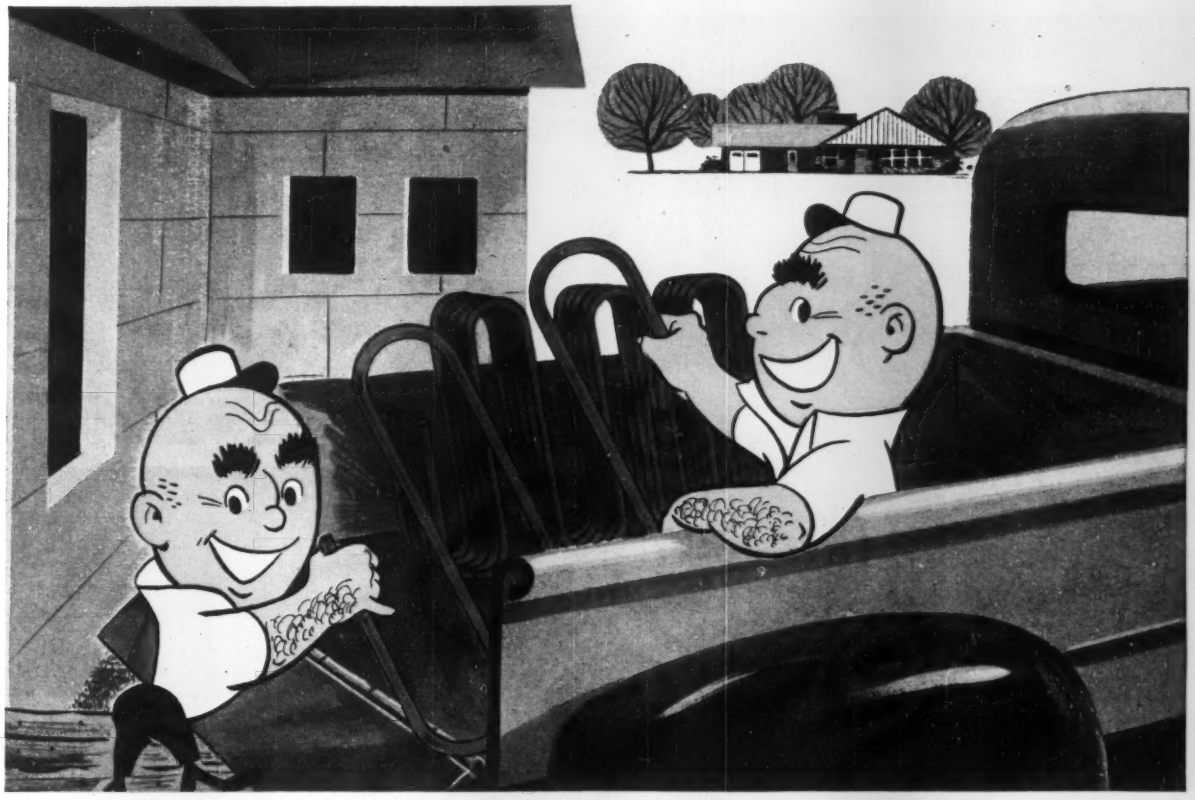
COAL prices will therefore remain the most stable of all fuels.

COAL is the safest fuel to store and use.

COAL is the fuel that industry counts on more and more—for with modern combustion and handling equipment, the inherent advantages of well-prepared coal net even bigger savings.

FOR HIGH EFFICIENCY FOR LOW COST

YOU CAN COUNT ON COAL!



How to install ceiling radiant heating at lowest possible cost

Long proved in thousands of ceiling radiant heating systems, Bundyweld Tubing gives you not only first-class performance, but brings you savings in material cost and fabrication time, too.

Bundyweld comes in standard 20-foot lengths with one end expanded, when specified, for easier, sounder joining. Though extra-strong, it's ductile and bends easily on a simple fixture in the shop or on the job site.

Bundyweld can be handled pretty roughly without danger of damaging it. It's lightweight enough (100′ of ⅜″ O.D. weighs only 10 lbs.) and rigid enough so that two men can easily position a group of joined coils. Then, the smooth, flat-lying coils can be speedily plastered. No waste motion, no waste material.

Your job is completed economically with low-cost tubing that will function efficiently and faithfully. Note below the reasons Bundyweld is the only tubing that can offer you those advantages. Then write us today for more information.

Radiant Heating Division
Bundy Tubing Company • Detroit 14, Michigan

Bundyweld® Tubing

DOUBLE-WALLED FROM A SINGLE STRIP.

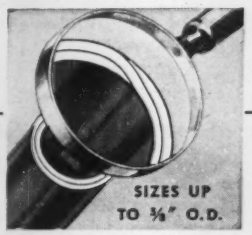
WHY BUNDYWELD IS BETTER TUBING

Bundyweld starts as a single strip of steel which is copper-coated. Then, it's . . .

continuously rolled twice around laterally into a tube of uniform thickness, and

passed through a furnace. Bonding metal fuses with basic metal. Result . . .

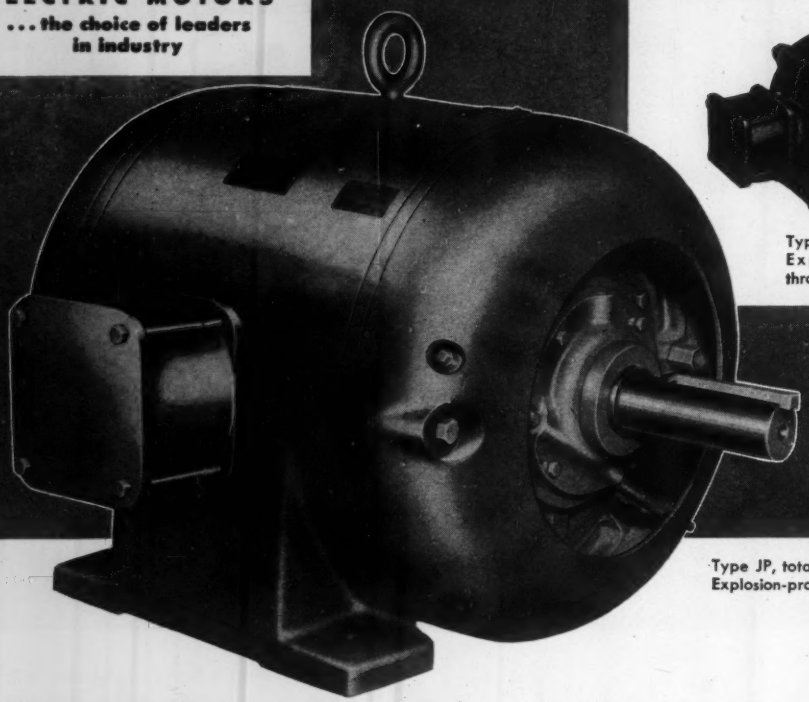
Bundyweld . . . double-walled and brazed through 360° of wall contact.



NOTE the exclusive Bundy-developed beveled edges, which afford a smoother joint, absence of bead, and less chance for any leakage.

Wagner®
ELECTRIC MOTORS
... the choice of leaders in industry

Type JP, non-ventilated. Explosion-proof. ½ through 1½ hp.



Type JP, totally-enclosed fan-cooled. Explosion-proof. 2 to 250 hp.

for extra protection against corrosion

SPECIFY Wagner CAST IRON FRAME MOTORS

Here are stock motors specifically designed for use in chemical plants, oil fields, refineries, steel mills—for rugged industrial applications where dust, dirt, moisture, or corrosive vapors are present.

These motors are totally-enclosed in corrosion-resistant cast iron and all parts exposed to the atmosphere are of corrosion-resistant material —including the nameplate. They feature completely protected laminations . . . special varnish treated windings . . . and a running shaft seal.

Wagner Cast Iron Frame Motors are available in fan-cooled standard and explosion-proof types in ratings from 2 to 250 hp, and in non-ventilated standard and explosion-proof types in ratings from ½ through 1½ hp. Wagner Bulletin MU-132 gives complete information.

A skilled Wagner engineer can help you select a Wagner Motor to meet your most exacting specifications. Call the nearest of our 32 branch offices, or write us.

Wagner Electric Corporation
EST. 1891

WAGNER ELECTRIC CORPORATION
6370 PLYMOUTH AVE., ST. LOUIS 14, MO., U.S.A.

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

ELECTRIC MOTORS
TRANSFORMERS
INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS— AIR AND HYDRAULIC

MH-8

Old timers will recall the day—more than 20 years ago—when Taylor Forge announced the first comprehensive line of butt-welding fittings.

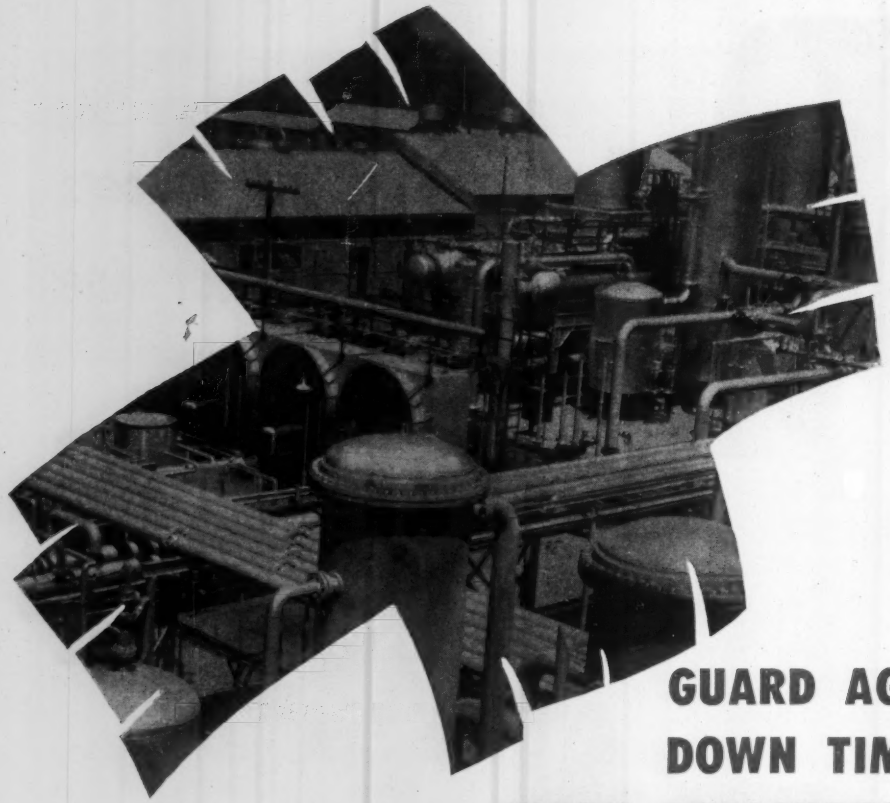
Before the WeldELL line was introduced, the only available welding fittings were elbows. But in the WeldELL line came all the fittings needed to do a complete and workmanlike job of pipe welding . . . the tees, reducers, caps, stub ends, and welding flanges.

To produce all of these types of fittings in seamless forged steel was a giant undertaking—and still is. A good example of this is the line of reducers. Today there are 175 reductions in standard weight reducers alone—and this can be multiplied by all the weights and materials in which Taylor Forge reducers are available.

The first line is still the foremost line—the engineered line, the full value line. For up-to-the-minute facts about the WeldELL line, see your Taylor Forge Distributor.

TAYLOR FORGE

TAYLOR FORGE & PIPE WORKS
General Offices & Works • Chicago 90 • P. O. Box 485
Plants at: Carnegie, Pa., Fontana, Calif., Gary, Ind., Hamilton, Ont., Canada



GUARD AGAINST DOWN TIME WHEN PRESSURES ARE UP

With Watson-Stillman Forged Steel Fittings . . .

The high cost of down time in today's high pressure processing and power plants demands careful selection of piping materials. This goes *double* for the fittings.

WATSON-STILLMAN FORGED STEEL FITTINGS give you maximum protection against high pressure, heat, corrosion, shock and vibration —elements often responsible for piping failures.

All W-S Carbon Steel Fittings are drop forged to produce the well-known forged-fiber structure with exceptionally high tensile and impact strength. They're designed for high strength, too, with extra heavy walls where you need them. And they're precision machined for perfect alignment.

Watson-Stillman Fittings are also available in forged stainless and alloy steels for exceptional service at high and low temperatures and for maximum resistance to corrosion.

For strong, tough, trouble-free joints—for safe, dependable operation of your piping system—specify W-S Forged Steel Fittings. Available in sizes ⅛" to 4" in both SCREW-END and SOCKET-WELDING types. Write for information today.

Sold Through Leading Distributors

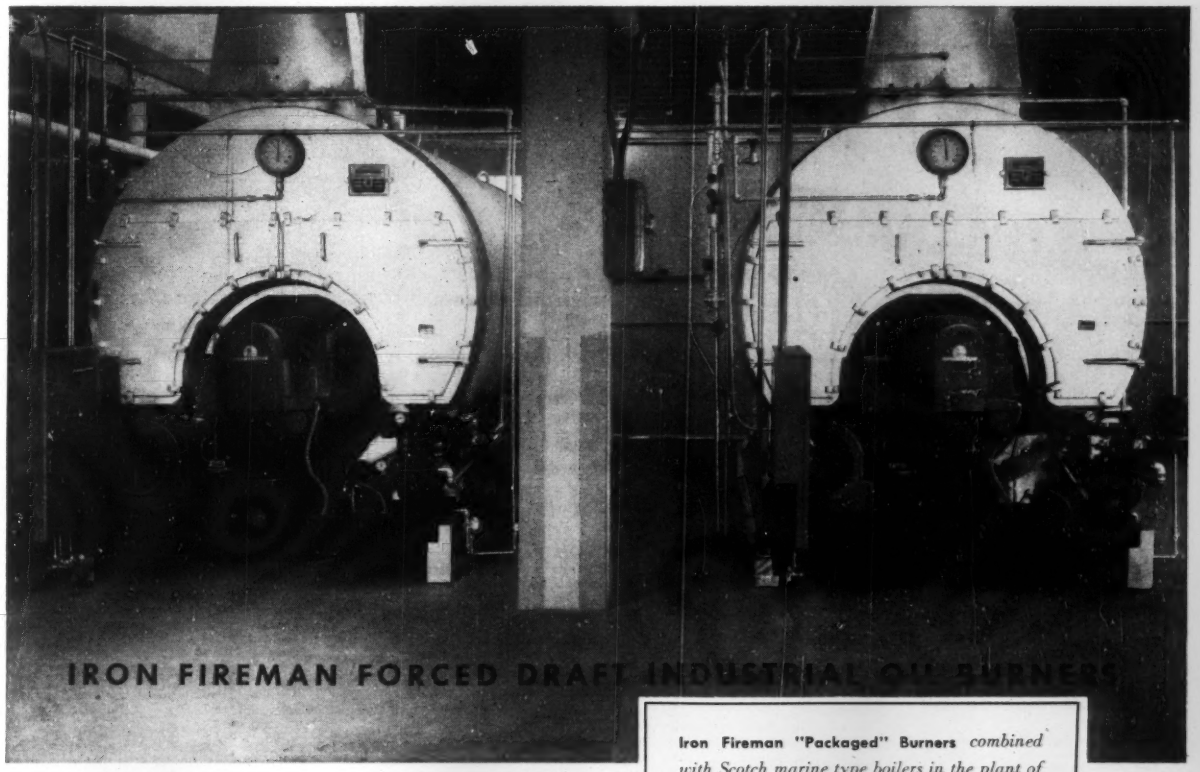
WATSON-STILLMAN FITTINGS DIVISION

H. K. PORTER COMPANY, INC.

Roselle, New Jersey

2

Buy your steam plant in a PACKAGE



Iron Fireman "Packaged" Burners *combined with Scotch marine type boilers in the plant of Belrug Mills, Inc., Greenville, S. C. Installation by Kirby Hammond, Inc., Greenville. Race, Forrester & Etting, Architects and Engineers.*

No divided responsibility . . .

No separate contracts for (1) boiler setting
(2) electrical wiring (3) oil heating equipment
(4) automatic control system (5) forced draft system
(6) boiler refractory

How to specify. First, decide what fuel or fuels you want to use (oil, gas or oil-gas combination). Second, determine the load. Third, refer to table in Iron Fireman catalog or specifications for the correct size of burner and boiler for your job.

The entire burner unit is assembled and tested at the factory, and is shipped to you ready for bolting to the boiler. Packaged unit includes: Iron Fireman oil, gas or combined oil-gas burner; wired and tested control panel; oil heating system; built-in forced draft with integral fuel and air controls.

Buy burner and boiler as integrated unit. You can install a complete new boiler plant quickly and economically by specifying an Iron Fireman packaged burner and a Scotch marine type boiler engineered specifically for use with this unit. Forced draft; no high stack required.

Or convert any old or new boiler.

This completely integrated combustion system can be installed in practically any type of existing boiler, with important savings in installation and operating costs.

The smart way to modernize. This Iron Fireman firing unit is much more than just a burner. It's a complete combustion system. To the user this means big savings in installation time and costs. But even more important, it means a factory built and tested unit instead of a locally assembled job. It means direct factory responsibility; high operating efficiency; substantial fuel savings. Send the coupon below for more information, or call your Iron Fireman dealer.

IRON FIREMAN MANUFACTURING CO.
3067 W. 106th Street, Cleveland 11, Ohio.

Please send detailed information on Iron Fireman packaged burner units for oil, gas and oil-gas combination firing.

Name_____

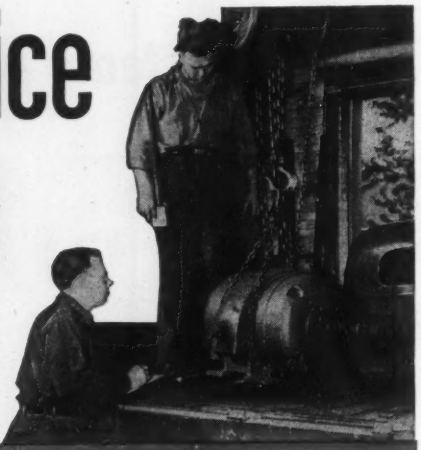
Address_____

City_____ State_____

Iron Fireman®

Oil, Gas, Coal firing for Heating, Processing, Power

Motor Repair Service Wherever You Are



ALLIS-CHALMERS "Certified" SERVICE

Factory approved motor service in every industrial area from 101 Allis-Chalmers Certified Service Shops.

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Greenville—Mowbray Eng. Co.
Montgomery—Standard Electric Co.

ARIZONA
Bisbee—Copper Electric Co. Inc.
Phoenix—Daley Electric Company

CALIFORNIA
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Los Angeles—Larsen-Hogue Elec. Co.
Oakland—Pacific Elec. Motor Co.
T. L. Rosenberg Co.
San Francisco—Weidenthal-Gosliner Electric Works

COLORADO
Denver—Baker Electric Company

CONNECTICUT
Hartford—Charles H. Leppert
Waterbury—Elec. Motor Repair Co., Inc.

FLORIDA
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ILLINOIS
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MARYLAND
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Lawrence—Roland B. Glines Co.
Springfield—Elec. Motor Repair Co.

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Dallas—Industrial Elec. Equipment Co.
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UTAH
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Morgantown—Galis Elec. Repair Co.

WISCONSIN
Baraboo—Utility Trans. & Equip. Co.
Green Bay—Beemster Electric Co.
Milwaukee—Dietz Electric Co.
Wausau—Electric Motor Service
Wisconsin Rapids—Staub's Elec. Wks.

ALLIS-CHALMERS CERTIFIED SERVICE SHOPS are independent service shops which have met rigid standards for ability, experience, equipment and business integrity. They use factory approved methods and parts and do your work promptly at a fair price.

Of course, Allis-Chalmers Certified Service Shops give good service on any electrical equipment, of any make. Save this ad, or write the name of the A-C Certified Service Shop nearest you in your address book. Allis-Chalmers, Milwaukee 1, Wisconsin.

A-4197

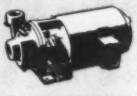
Texrope and *Vari-Pitch* are Allis-Chalmers trademarks.

Sold . . .
Applied . . .
Serviced . . .

by Allis-Chalmers Authorized Distributors, Certified Service Shops and Sales Offices throughout the country.

CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

***TEXROPE* — Belts in all sizes and sections, standard and *Vari-Pitch* sheaves, speed changers.**



PUMPS — Integral types from ¾ in. to 72 in. discharge and up.

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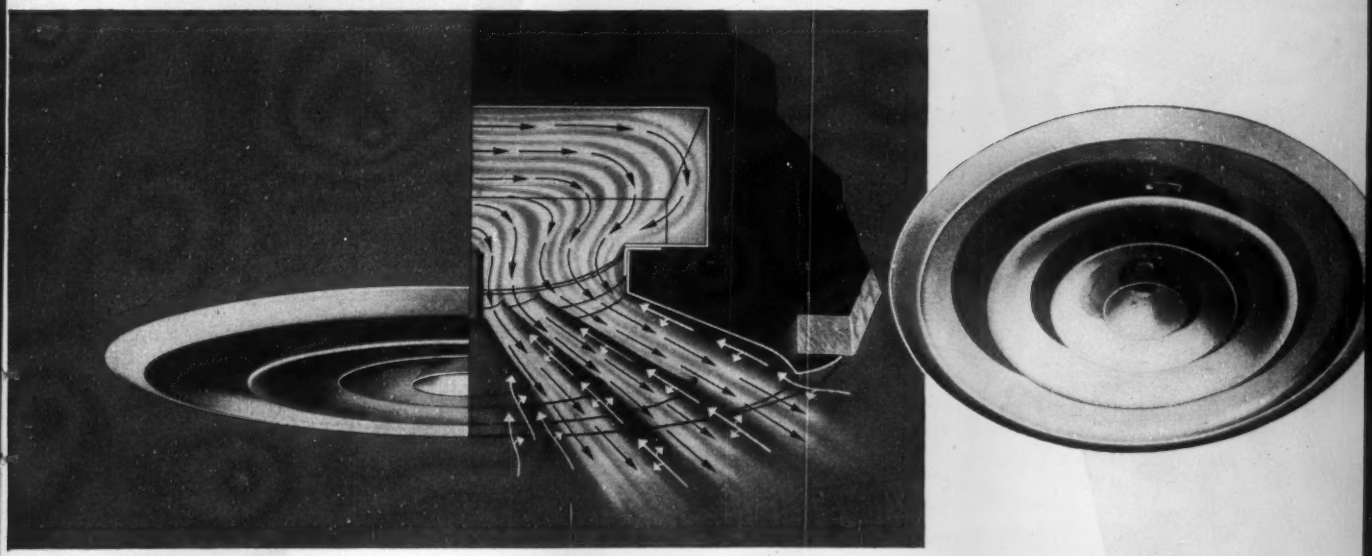
ANEMOSTAT

key to

comfort in air conditioning



The aspiration principle of all Anemostat Air Diffusers is the induction of room air into the outlet by the primary air stream.

ANEMOSTAT®

DRAFTLESS *Aspirating* AIR DIFFUSERS

ANEMOSTAT CORPORATION OF AMERICA

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REPRESENTATIVES IN PRINCIPAL CITIES

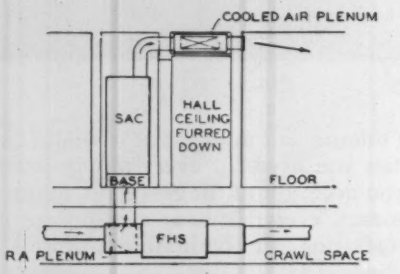
"No Air Conditioning System Is Better Than Its Air Distribution"

Seventeen years ago, Anemostat Corporation of America introduced the Aspirating Air Diffuser, which was promptly accepted by the air conditioning industry. • Through research and development and experience gained over the years in tens of thousands of installations, we have consistently improved the quality and performance of Anemostat products. • Value, quality and performance of Anemostat Air Diffusers are still unequalled—there are no "substitutes" for Anemostat Air Diffusers.

Let others talk about the weather ...you can control it with ®*Janitrol* Cooling

With the Janitrol Summer Conditioner, Model SAC, you have new flexibility in designing year 'round conditioning in either residential or commercial installations. The sketches below show a few typical arrangements in combination with vertical, horizontal and duct heating units.

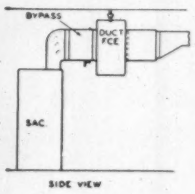
HORIZONTALS

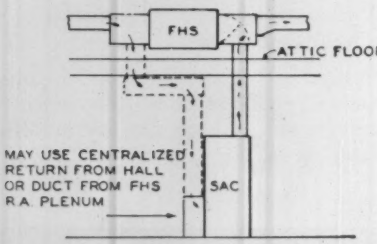


COOLING UNIT LOCATED IN CLOSET WITH DISTRIBUTION FROM CENTRAL HALL PLENUM AND RETURN AIR IN CONNECTION WITH HEATING SYSTEM IN BASEMENT

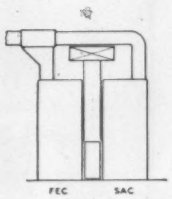
VERTICALS

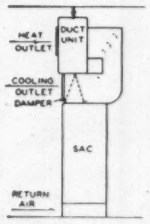
DUCTS





FHS IN ATTIC - SAC IN CLOSET OR UTILITY ROOM
SIDE VIEW





WRITE TODAY FOR COMPLETE SPECIFICATIONS AND DETAIL DRAWINGS

Specify the finest year 'round conditioning ...with confidence!

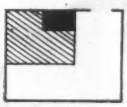
®Janitrol Win-Sum Twins

ALL SEASON COMFORT NOW PRACTICAL FOR HOME AND BUSINESS

Year 'round conditioning, the Janitrol way, need not be confined to so-called luxury installations. This year, Janitrol Win-Sum Twins will help your builder clients move their houses-for-sale easier and faster.

In your modernizing and building additions work, the inclusion of summer cooling can increase property values far more than the cost of Janitrol cooling equipment.

For your client's protection, you can depend on well engineered installations of Janitrol year 'round conditioning ideally suited for your plans. Because, Authorized Janitrol dealers are selected for their experience . . . are factory and field trained in modern installation techniques.



SPACE SAVING

You need only a 27" square for the 2 or 3-ton Janitrol conditioners. They are out of the way in the utility or recreation room.

5-YEAR WARRANTY

The Janitrol unit is factory sealed. Maintenance is minimized. This cooling system is fully covered by a 5-year warranty.

WHISPER QUIET

Janitrol is the quietest unit made. Rubber mountings and thick insulating blanket lining efficiently absorb operating sounds.

FILTERED COOLING

Over 5 square feet of filters removes the dust, dirt and pollen from Janitrol cooled air for a healthier, cleaner home.

Check yellow pages in your phone book under "furnaces" for names of local Janitrol representatives.

®Janitrol

DIVISION • SURFACE COMBUSTION CORP.

400 DUBLIN AVE., COLUMBUS 16, OHIO

For Step No. 3 in perfecting air conditioners . . .

1. Cooling

2. Dehumidifying

3. Controlling Noise

L·O·F FIBER·GLASS for Noise Control

In Step No. 3—the control of noise—air-conditioning engineers tell us that two kinds of L·O·F Fiber·Glass are indicated;—

One is the same basic material now used as thermal insulation for air-conditioning ducts—flexible, blanket-type L·O·F Super·Fine Fiber·Glass. This provides high-efficiency *sound* insulation; absorbs airborne sounds in the middle- and high-frequency ranges. Vinyl-faced Super·Fine is specified for highest sound-absorbing efficiency.

To reduce noises created by vibration, L·O·F now makes available High Density Compressed Fiber·Glass. This is a new form of compressed, high density Fiber·Glass which can be molded, if desired, into shapes. It can be used to form blower housings and air intake deflectors, and to line cabinets.

L·O·F Fiber·Glass in both forms is easily handled, easily cut and easily installed. The fine glass fibers will not burn, absorb moisture, mildew or rot.

For consultation on applying both L·O·F Super·Fine and L·O·F High Density Compressed Fiber·Glass to air conditioning units, call your nearest L·O·F office (offices in 26 major cities). Or write: Libbey·Owens·Ford Glass Company, Fiber·Glass Division, 3924 Wayne Building, Toledo 3, Ohio.

LOF GLASS · LOF Corrulux · LOF FIBER·GLASS

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LIBBEY·OWENS·FORD GLASS COMPANY
FIBER·GLASS DIVISION

perfect solution to extra heating needs

UTILITY'S NEW 85FA FORCED AIR FURNACE

When the job calls for an "in-between" heating system, Utility's new 85FA is the answer.

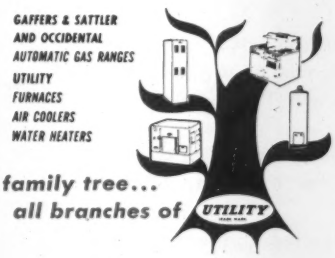
Filling the gap between Utility's Model 70FA and Model 100FA, this new unit is ideal for smaller installations that require extra heating capacity or for larger installations where layout and ducting design make this unit fully adequate.

85FA, like all Utility automatic forced air furnaces, is equipped with Utility's exclusive Sy-Lent* Heat Exchanger and Dy-Rekt* Drive Blower, and is approved by the American Gas Association for zero clearance.

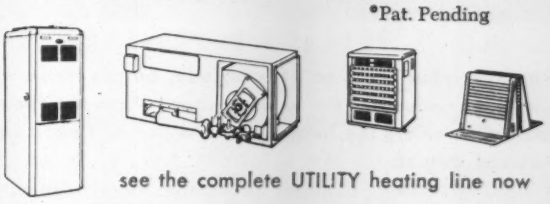
Extremely compact, it can be installed in the closet, alcove or service porch, at a minimum of expense.

Compare Utility's 85FA Forced Air Furnace for price . . . for efficiency . . . for freedom from service problems . . . for customer satisfaction . . . and you'll choose it to "sell the job."

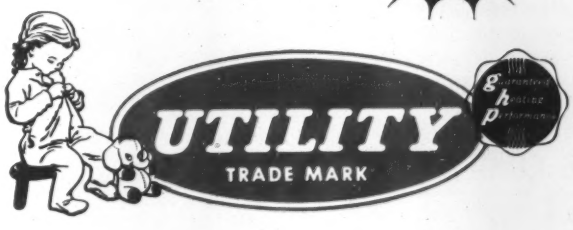
*Pat. Pending



a happier living family tree...
all branches of UTILITY



see the complete UTILITY heating line now



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Please send me free information on:
- ☐ Utility Automatic Heating Equipment
- ☐ Utility Cooling Equipment
- ☐ Utility Automatic Gas Water Heaters

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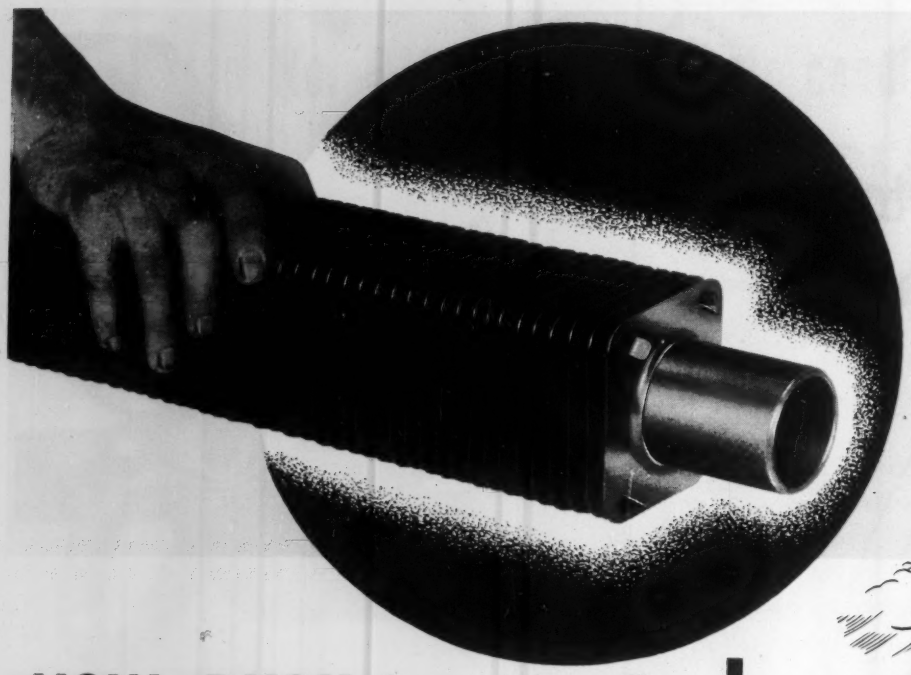
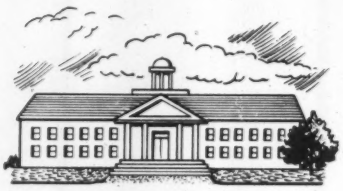
Address_____

City_____ Zone____ State_____



NOW...BUSH Industrial Fin to meet all specifications



Whatever your specs call for on size, output, tube, construction, etc., BUSH can now supply an industrial fin to meet them. With the recent addition of a 4¼" x 4¼" fin, BUSH now offers the heating man a line of finned surface with flexibility to meet any required output.

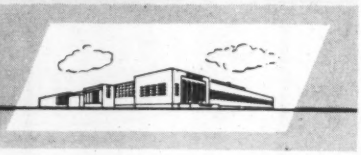
What's more, changes in design have been made that simplify installation . . . insure an even better job. Improved expansion hangers, for example, catch under fingers on the fin . . . provide support *from both sides.*

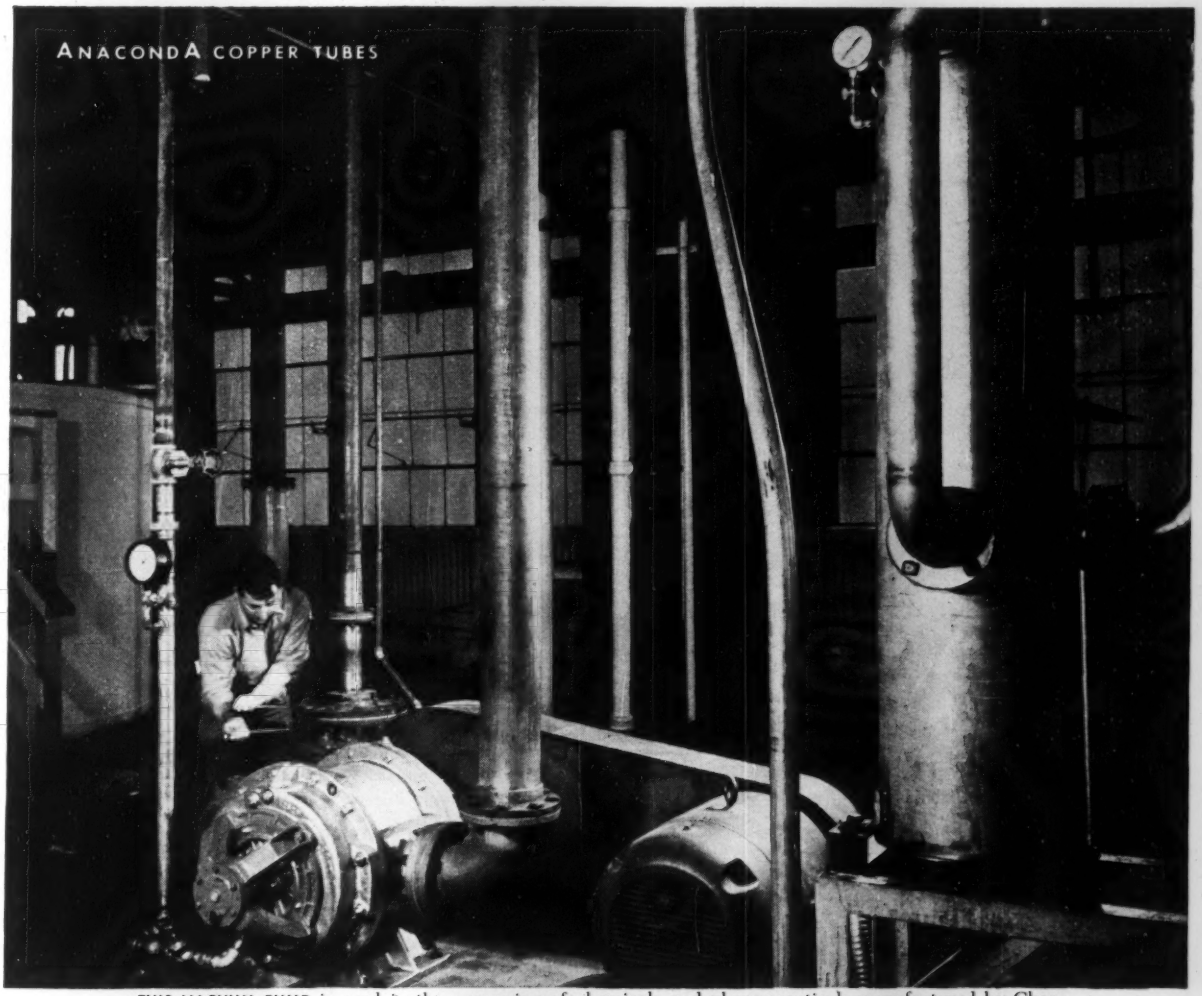
For all your commercial, industrial or institutional heating applications, choose BUSH Industrial Fin — now available to meet all specs.

Write today for free illustrated bulletin.

BUSH MANUFACTURING COMPANY

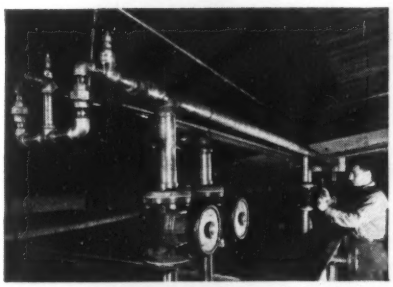
WEST HARTFORD 10, CONNECTICUT





THIS VACUUM PUMP is used in the processing of chemicals and pharmaceuticals manufactured by Chas. Pfizer & Co., Inc. 4-in. copper tubes and 6-in. red brass pipe are used for suction and discharge lines.

This plant's piping will last longer –cost less because it's copper



THESE CHEMICAL PROCESS LINES of 1½-in. and 2-in. copper tubes in the Chas. Pfizer & Co., Inc. plant use both copper solder-type and S.P.S. bronze fittings joined by silver-alloy brazing.

NOT ONLY the first cost, but how long it will last and how much it costs to install are the measures of true industrial piping costs.

Where corrosion shortens piping life, where rust and scale form to restrict flow and increase pumping costs, there you should consider copper's corrosion resistance and immunity to rust—properties that endow copper piping with its long life.

Lightweight copper tubes are far less costly to erect; when used with solder type fittings, they cost far less to install than heavy, threaded pipe. In fact, it is not unusual for labor savings to bring the installed cost of a copper tube, solder fittings system below that of rustable piping.

For examples of the wide use of copper in industrial piping and for detailed information on ANACONDA Copper Tubes and Solder Type Fittings, let us send you a copy of Publication C-24. Write to *The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.* 5336

for copper piping call an

ANACONDA®

Distributor

IT'S SKILL THAT COUNTS

Yes, to accomplish a difficult feat, it is the skill that counts. — It's that way with building good heaters too. —

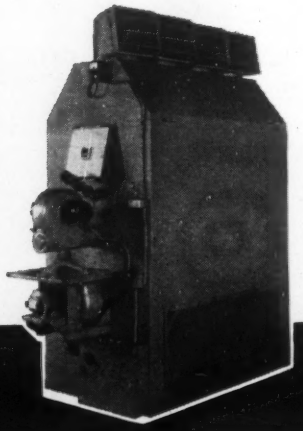
Great pains are taken to manufacture and assemble Olson Heaters. The material and parts are carefully selected. Every moving part and every fitting is expertly produced to give smooth service for years to come. The wiring, the automatic controls, the fine welding and every detail of Olson Heaters are touched only with hands of the utmost skill. Another reason why Olson Heaters are known as outstanding in their field.

And, the fact that Olson Heaters are built rugged for dependable service cannot be denied. — Write for detailed step-by-step catalog and you'll know why.

Olson

DIRECT FIRED HEATERS

Gas, Oil, Coal or Dual Gas and Oil



Arthur A. Olson & Company
Canfield, Ohio
Please send me your catalog F50.
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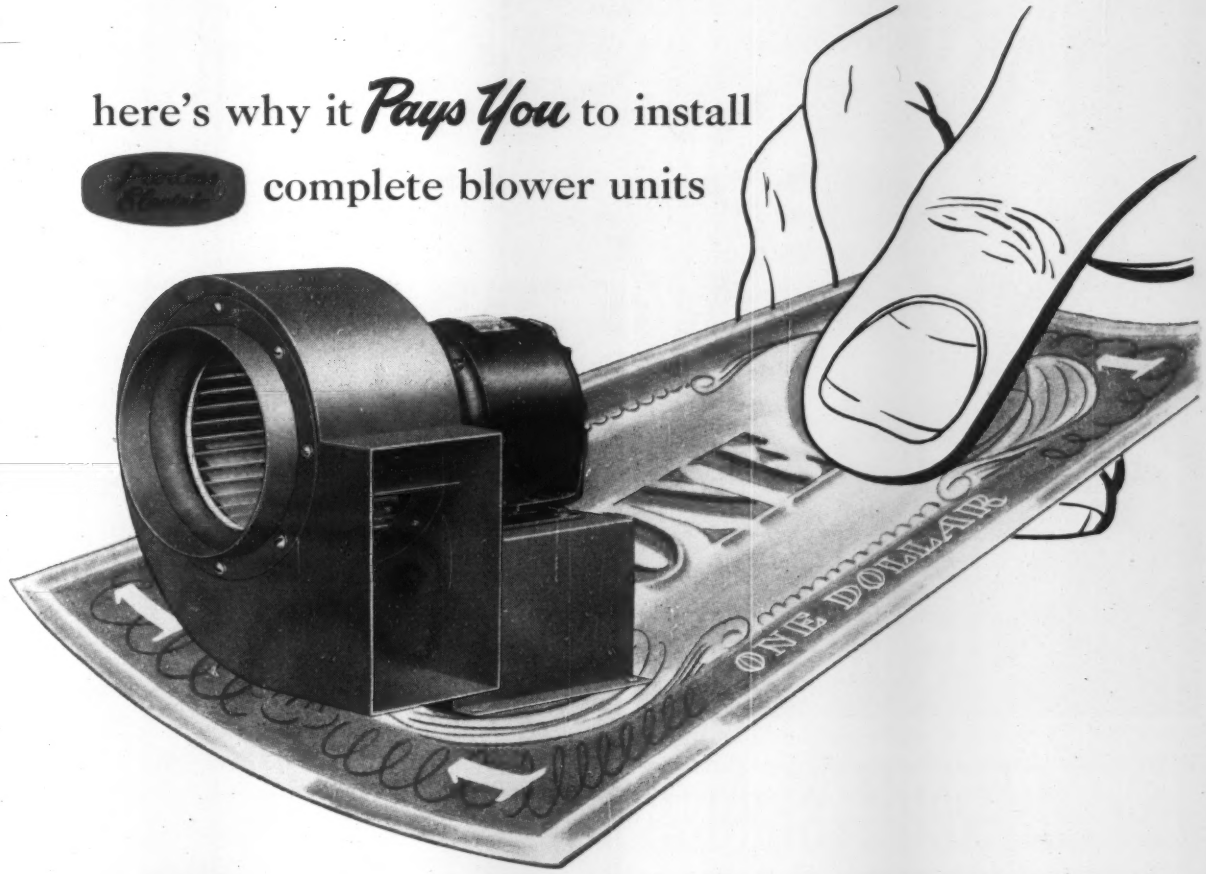
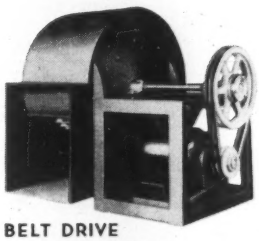
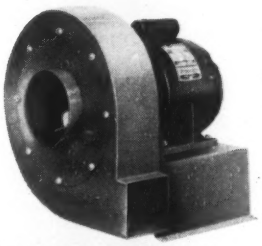
ARTHUR A. OLSON & COMPANY
BROAD ST. · CANFIELD, OHIO

here's why it *Pays You* to install Peerless complete blower units





BELT DRIVE
UTILITY BLOWERS



PRESSURE BLOWERS

● Complete, ready-to-install Peerless Blowers are equipped with job-matched Peerless motors. They're sturdily enclosed in all-welded housings that dampen vibration and noise, and stimulate turbulent free air delivery.

Peerless Blowers are easy to install, and, once in operation, they keep going without adjustments.

Profits aren't siphoned off by costly service calls when you install Peerless Fans and Blowers and, since responsibility is centered under one roof for motor, fan and frame . . . you're sure of faster service, better guarantees.

Write today for new catalog showing the complete Peerless line, available through your favorite distributor.

Fan and Blower Division
THE PEERLESS ELECTRIC COMPANY
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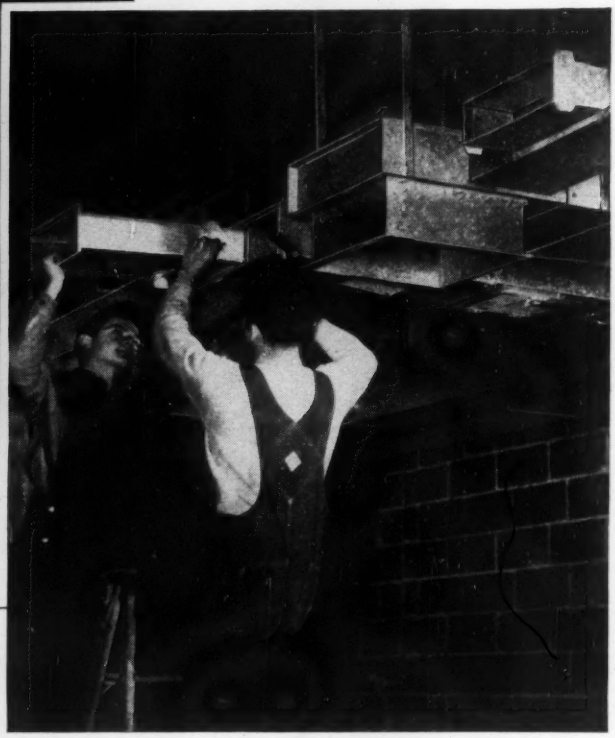
Peerless Electric

For tight neat bends...



difficult shapes and angles...

use U·S·S GALVANIZED STEEL SHEETS

● To facilitate handling of your more complicated jobs . . . to meet the requirements of exacting clients . . . always use U·S·S Galvanized Steel Sheets on all types of ductwork installations, from small pipe residential heating units to large air conditioning systems for plants and offices.

U·S·S Galvanized Steel Sheets are fabricated from high-quality carbon steel, with a uniformly heavy coating of zinc that won't flake or crack, assuring lasting protection from rust and corrosion. Because all U·S·S Steel Sheets are uniform in flatness, ductility and workability, they can be bent, cut, stamped, welded or soldered quickly and easily.

Your customers know and appreciate the quality that stands behind the U·S·S Label appearing on U·S·S Galvanized Steel Sheets. It will pay you—in satisfied customers and repeat orders—to cash in on the wide acceptance of this well-known product.

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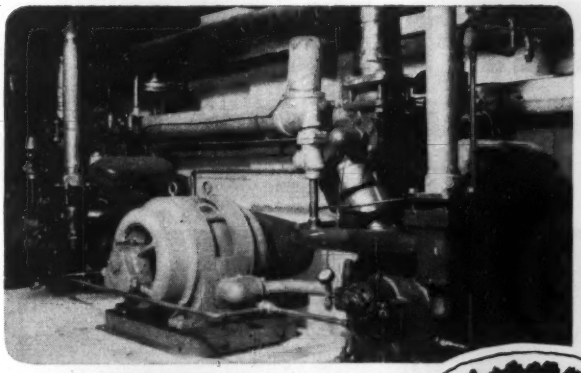
U·S·S GALVANIZED STEEL SHEETS

UNITED STATES STEEL



Two Frick 6-Cyl. "ECLIPSE" Compressors are the Heart of Air Conditioning System of Club at Right

More Than 300 People Enjoy Cool, Fresh, Clean, Dehumidified Air in This Club Banquet Room

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Air Conditioning and Refrigeration

Engineered To Suit Every Need

Small business operators; industrialists; hotel, apartment and tourist court men; theater owners; club managers; city, state and government officials; engineers, architects and contractors—they all specify Frick air conditioning and refrigeration when they want the finest, most dependable and most economical cooling system.

When you purchase a Frick installation you get not only superior equipment manufactured to the highest standards, but also the services of highly trained engineers, who design the system specifically to meet **your** cooling requirements.

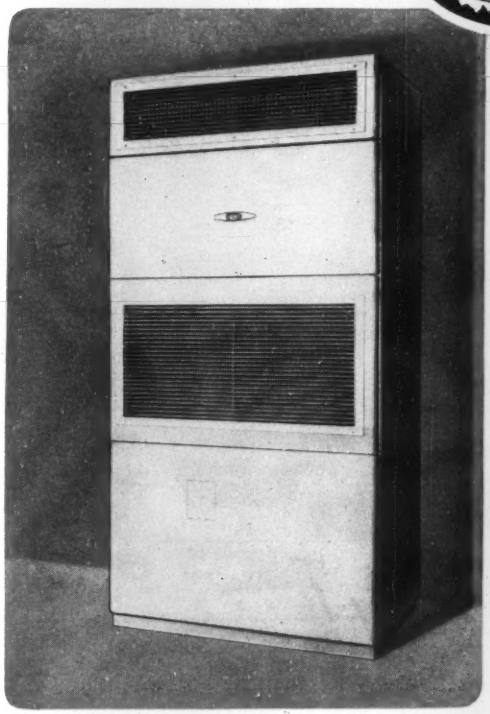
Write today for catalogs and quotations.

DEPENDABLE REFRIGERATION SINCE 1882

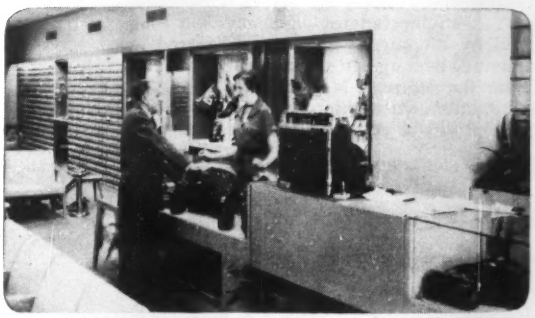
FRICK CO.

WAYNESBORO, PENNA. U.S.A.

Also Builders of Power Farming and Sawmill Machinery



Frick Unit Air Conditioners are Manufactured in 3, 5, and 7½ Horsepower Sizes—Give More Cooling Per Dollar

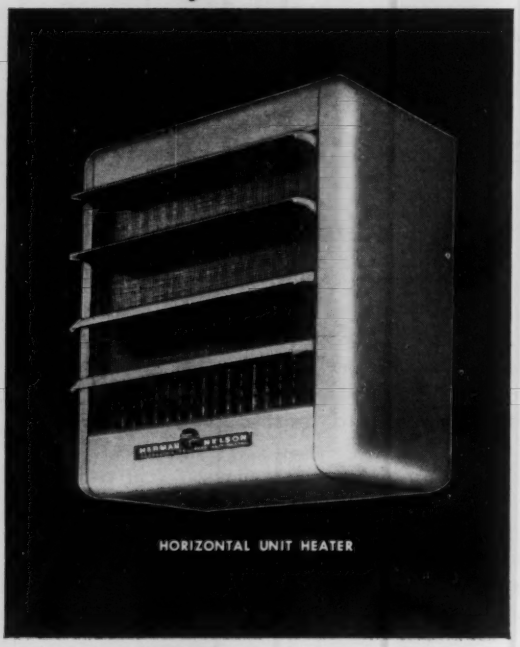


Shoe Stores, Drug Stores, Supermarkets, Shopping Centers, Department Stores Can All Increase Sales With Frick Year 'Round Air Conditioning

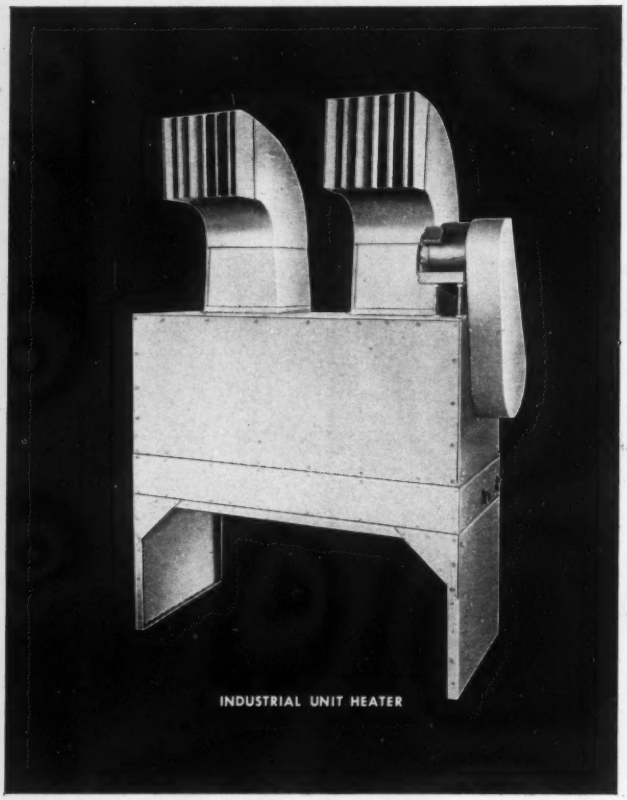
When the Owner of This Tourist Court Installed Air Conditioning, He Chose Frick—a Leader in the Field for Over Fifty Years

Job-rated HERMAN NELSON UNIT HEATERS

regular or KING-SIZE...



HORIZONTAL UNIT HEATER



INDUSTRIAL UNIT HEATER

They Satisfy!

Pleasing customers is easy when you have the complete Herman Nelson line to draw upon! In all, 63 models and sizes in unit heaters, give you a wealth of sizes and capacities to handle all types of installations . . . from small stores and offices to large industrial jobs. Herman Nelson Unit Heaters are styled with clean, modern lines . . . engineered for efficiency and long life . . . backed by a company that has pioneered in the development of heating and ventilating equipment. Standardize on the Herman Nelson line . . . the line that means maximum satisfaction to your customers, and maximum profits to you year after year.

SEND TODAY *for complete descriptive literature*

Choose the right unit heater for your job from the complete Herman Nelson line.

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AMERICAN AIR FILTER OF CANADA, LTD.
Montreal, P. Q.

ALLIS-CHALMERS

Air Conditioning PUMPS

3 Ways to Save

SAVE ENGINEERING TIME

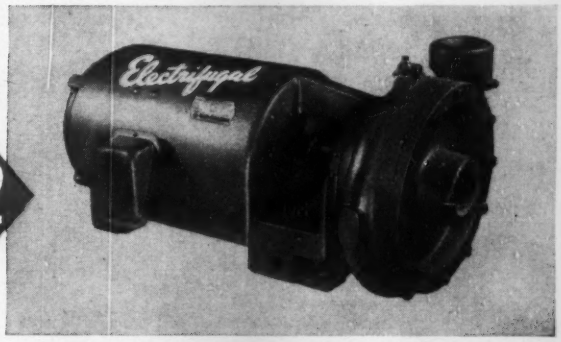
1

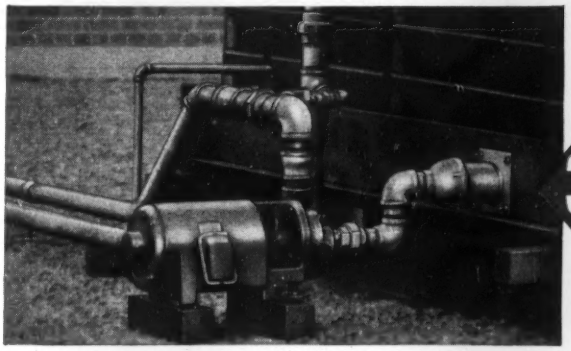
Allis-Chalmers representative will sit down with you in the planning stage and help you design the best possible air conditioning pump set-up at the lowest cost. A-C field engineers will save you much costly engineering work and *guarantee* the complete pump and motor unit.

SAVE—NO EXTRA PARTS TO BUY

2

Designed as a complete, compact unit, Allis-Chalmers close-coupled pumps don't require extras — such as couplings, bases or shims. The pumps come as units ready to hook up and run!





SAVE ON INSTALLATION TIME

3

Bolt it down, hook up the line and piping, and your Allis-Chalmers pump is ready to go. There's no alignment problem. Correct installation is a big factor in pump performance and the A-C engineer will advise you at this point.

For more information about Allis-Chalmers air conditioning pumps, write for bulletins 52B6140, 52B7529, 52B6083 or 52B6975.

ALLIS-CHALMERS, Milwaukee 1, Wisconsin

FHP PACKAGE PUMP

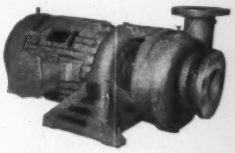
Standard with mechanical seal. Widely used and accepted for air conditioning and refrigeration.

Bulletin 52B7529

***ELECTRIFUGAL* PUMP**

A close-coupled pump with either conventional packing or mechanical seal.

Bulletin 52B6140



SUPPORTING ADAPTER PUMP

Flange motor and pump on sturdy supporting adapter. With conventional packing or mechanical seal.

Bulletin 52B6083

VERTICAL MOUNTED PUMP

Mechanical seal or sealless units with choice of submerged or sidewall mounting.

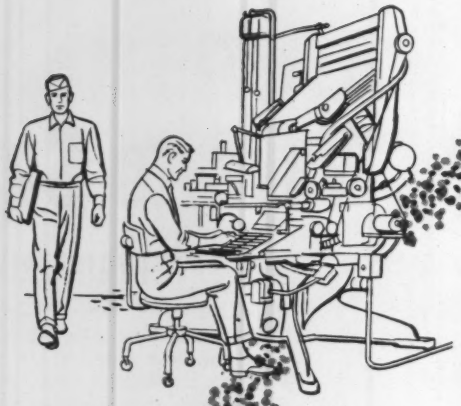
Bulletin 52B6975

Electrifugal is an Allis-Chalmers trademark.

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

A-4210



WORDS BY THE MILE...ON METAL

The history of tomorrow is being chronicled today on the pages of America's great newspapers. Speed and precision work hand in hand to bring you up-to-the-minute news in accurately set easy-to-read type.

Progress has been the constant and continuing objective of typesetting machine manufacturers since their inception, in 1901. Emerson-Electric was selected to pioneer in the powering of these early machines and over the years has kept pace with the newest developments.

Your product, too, can benefit from Emerson-Electric's 63 years of motor manufacturing experience. We specialize in building dependable motors in ratings from 1/20 to 5 h.p., and hermetic motors from 1/8 to 20 h.p. Your inquiry is invited.

THE EMERSON ELECTRIC MFG. CO.

ST. LOUIS 21, MO.

Write for these Emerson-Electric Motor Data Bulletins

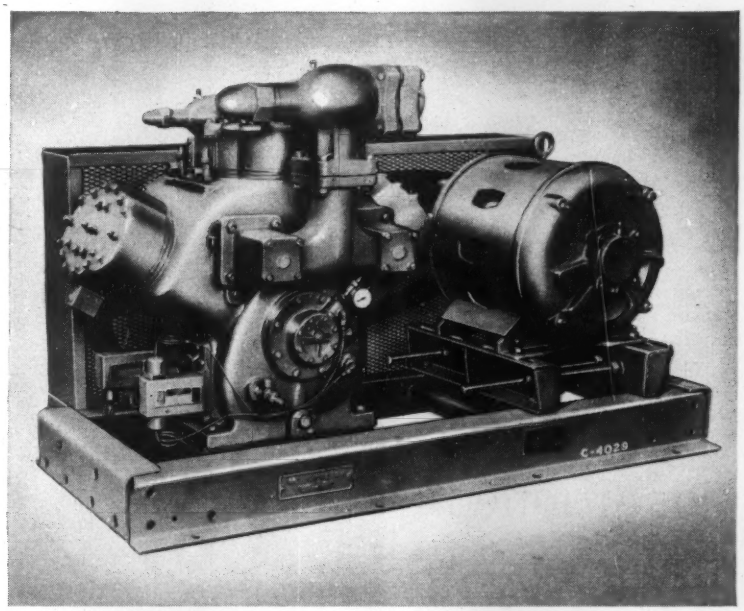
Manufacturers requiring motors 1/20 to 5 h.p. can profitably use these reference guides. Specifications, construction and performance data are included for these motors:

- ☐ 472-A Capacitor-Start
- ☐ 472-B Split-Phase
- ☐ 472-C Integral
- ☐ 472-D Fan-Duty
- ☐ 472-E Oil-Burner
- ☐ 472-F Jet Pump
- ☐ 472-G Blower

EMERSON ELECTRIC

MOTORS • FANS APPLIANCES

The whole industry's talking about Worthington's new Freon compressor



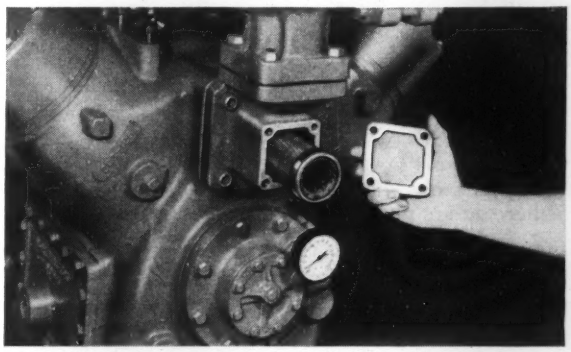
TRIM, STURDY CONSTRUCTION marks this 4JF6 compressor unit — 50-60 hp, six cylinder W-type compressor. The complete compact unit consists of fabricated steel base, compressor with valves, gauges and safety controls, drive and safety guard. Designed to operate in conjunction with Worthington evaporative condensers in localities where city water is scarce or high in cost. Also available with shell and tube condenser. Complete range from 3-150 hp.

"The high capacity unit we've been waiting for!"

"Greater operating efficiency!"

"There's nothing else like it!"

And every comment you hear is true! The refrigeration compressor is the most vital element of any air conditioning or refrigeration system. That's why Worthington spent years in developing the new "J" Freon compressor. That's why Worthington invested over a million dollars in compressor research. *And that's why you can't find its match in any other unit.* Only a few features of the new "J" Freon compressor are highlighted here — get the full story by contacting your nearest Worthington district office or write to Worthington Corporation, Air Conditioning and Refrigeration Division, Section A.4.33, Harrison, New Jersey.



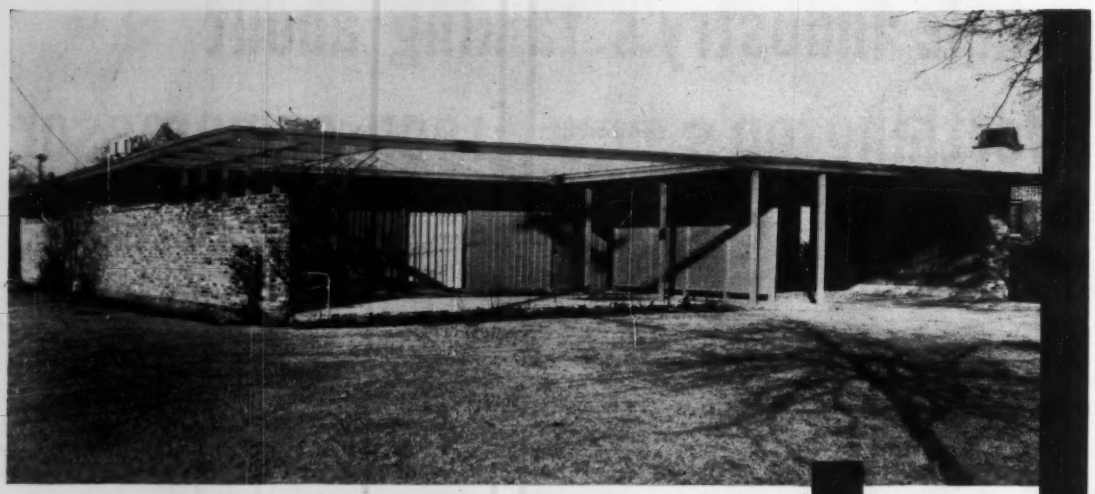
EASY REMOVAL of suction gas strainer for cleaning is made possible by new suction manifold design. No pipes, valves or other parts need to be dismantled in order to get at the strainer. And Worthington's new electric unloaders automatically balance power consumption with load requirements.

LORD & TAYLOR'S new West Hartford, Conn., store depends on Worthington to provide comfortable air conditioning for its customers. Two 150 hp "J" compressors and two evaporative condensers make up the highly efficient Worthington air conditioning team at this modern store.

A.4.33

WORTHINGTON

CLIMATE ENGINEERS TO INDUSTRY, BUSINESS AND THE HOME

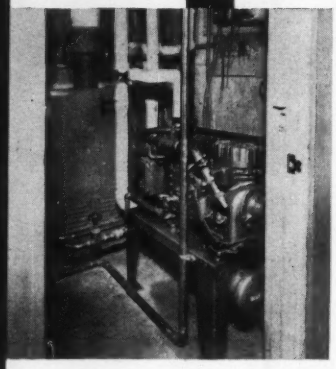


The new home of Herman Blum which received a second honorable mention from the Dallas Chapter of American Architects.

Prize-Winning Home

healthfully air conditioned

by Acme FLOW-COLD®



The Flow-Cold Liquid Chiller fits conveniently in a hall closet to provide a central cooling plant for the whole house.

A central air conditioning plant that fits snugly into a hall closet is just one of the many outstanding design features of this functional modern home located in Dallas, Texas. Selected for its compact size, quiet and efficient operation was the Acme Flow-Cold Packaged Liquid Chiller. Design conditions called for the unit to cool 15 GPM of water from 53 degrees to 45 degrees, thus handling a load of 5 tons. By keeping this 3-bedroom ranch type home comfortable in the hottest Texas weather, the Acme Flow-Cold has proved the wise choice of consulting engineer, Mr. Herman Blum, and the efficient installation of the Beard Plumbing Co.

The Flow-Cold Packaged Chiller was installed in conjunction with a hot water boiler and circulates chilled water in the summer and hot water in winter, with convectors in each room for year-round air conditioning. Versatile, easily installed and pre-tested at the factory, the Acme Flow-Cold can be used effectively by you in your next job — whether you are designing or building homes.

Write us today for more complete information.

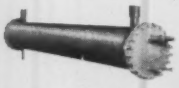
ACME AIR CONDITIONING REFRIGERATION

ACME INDUSTRIES, INC.

Mfgs. of a complete line of Air Conditioning and Refrigeration Equipment

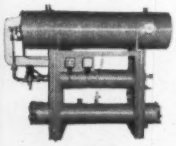
JACKSON, MICHIGAN

Evaporative Condensers
Cooling Towers
Floor-type Unit Coolers

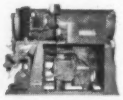


Direct Expansion (Dry-Ex) and Flooded Liquid Chillers
—
Heat Exchangers, Oil Separators

Shell and Tube, Shell and Coil Condensers
—
Receivers, Pipe Coils



Packaged Liquid Chillers to 225 tons



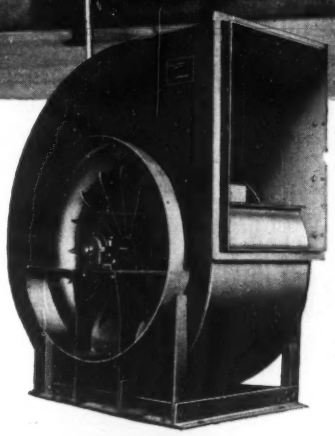
Flow-Temp Heat Pumps
—
Flow-Cold Liquid Chillers

Remote Room Conditioner

Continuously serving the air conditioning and refrigeration industry since 1919

DOORWAY TO THE

Perfect Climate...



100 Park Avenue Building, New York City. Architect: Kahn & Jacobs, New York City. Engineers: Jaros Baum & Bolles, New York City. General Contractor: George A. Fuller Co., New York City. Heating, Ventilating & Air Cond. Contractor: Kerby Saunders, Inc., New York City. Fans by Buffalo Forge Company, Buffalo, New York.

100 PARK AVENUE, New York's First Entirely Air Conditioned Building Uses "Buffalo" Fans Throughout

Whether your need is for ideal indoor weather such as the occupants of the beautiful 100 Park Avenue Building enjoy — or mechanical draft, process control, exhaust, air cleaning or straight ventilation — look to "Buffalo" for the dependable air power you'll need. The "Buffalo" line includes centrifugal fans and blowers, axial flows, propeller fans and air washers, comfort conditioning cabinets, and cleaning equipment. Trained "Buffalo" Engineering Representatives in principal cities are ready to give you sound advice on the best possible selection for your requirements. Why not call in one of these engineers today?

Shown here is the new "Buffalo" Type "BL" Limit-Load Ventilating Fan, the quietest, most efficient and trouble-free unit in our long history of manufacturing air moving equipment. Its new bell-shaped inlet with fixed inlet vanes — its new rotor shroud, plus many other new design features, are just a few of the reasons you'll continue to find "Buffalo" Fans specified for the big jobs. You'll be interested in the many features that make the "BL" Fan today's best buy. Engineering Bulletin F-100 gives all the facts.

BUFFALO FORGE COMPANY

171 Mortimer St. Buffalo, N.Y.

PUBLISHERS OF "FAN ENGINEERING" HANDBOOK

Canadian Blower & Forge Co., Ltd. Kitchener, Ont.
Sales Representatives in all Principal Cities

"Buffalo"

VENTILATING AIR CLEANING AIR TEMPERING INDUCED DRAFT EXHAUSTING FORCED DRAFT COOLING HEATING PRESSURE BLOWING

WOOD WON'T ROT WHEN IT'S COLD AND DRY

Living fungi, which break down the substance of wood are microscopic and abundant. But they need WARMTH and DAMPNESS to develop. Dampness will also peel off paint, crumble plaster, cause iron and steel to rust.

Some insulations can promote and retain destructive condensation inside walls and other structural spaces. Warmth and vapor can flow through asphalt, paper, plaster and most building materials, including ordinary insulations. Vapor condenses when, upon striking a colder surface, the air reaches a dew-point.

An empty space, the best insulator against heat flow by Conduction, does not prevent heat flow by Radiation and Convection. Of all heat transferred through structural spaces, about 50% to 80% is by Radiation; all but about 7% of the rest is Convection. The surfaces of multiple accordion aluminum sheets have a reflectivity for heat rays of 97%; absorptivity and emissivity of only 3%. The aluminum and fiber layers retard Convection. Conduction is slight through the preponderant low density air spaces.

The tough aluminum sheets used in multiple accordion aluminum are impervious to water vapor, and are long and continuous. Infiltration under flat, stapled flanges is slight.

Where multiple accordion aluminum is used, fortuitous vapor and water (for instance rain) which intrude into wall and similar spaces will gradually flow out as vapor through exterior walls and roofs as pressure develops within, because vapor flows from areas of greater to less density. The vapor cannot back up through the continuous, impervious aluminum, so it flows out because exterior walls and roofs have substantial permeability in comparison with aluminum, far greater than the required 5 to 1 ratio.

An improved* multiple accordion aluminum, Infra Insulation, Types 6-*Si* and 4-*Si*, gives the entire area between joists maximum, edge to edge, uniform depth protection against heat loss and condensation formation. Samples sent on request.

The U. S. NATIONAL BUREAU OF STANDARDS brochure: "Moisture Condensation in Building Walls," discusses vapor and heat flow, and the causes and prevention of condensation. Use the coupon. Get a copy at our expense.

*Patent applied for

COST OF INFRA INSULATION INSTALLED in new construction between wood joists, material with labor,

Type 6-Si under 9½¢ sq. ft.
Type 4-Si under 7½¢ sq. ft.

Infra Insulation Inc., Dept. H-2
525 Broadway, New York, N. Y.

☐ Please send FREE U. S. Bureau of Standards Booklet BMS63

☐ Please send samples

Name_____
Firm_____
Address_____

INFRA INSULATION, INC., 525 Bway., New York, N. Y. WOrth 4-2241

THE EDITORS' PAGES

• As this is being written, we're getting ready to leave for Houston — the "most thoroughly air conditioned city" — to attend the annual meeting of the American Society of Heating and Ventilating Engineers. Many of the meeting papers have already been published in the ASHVE Journal Section (which appears each month in HPAC), others are in this issue, and the rest — together with the official "Proceedings" — will follow.

Predicts $5 Billion a Year for Air Conditioning

AIR CONDITIONING sales registered their greatest expansion to date during 1953. Total retail volume increased to about $1¾ billion as compared with $1¼ billion in the preceding year, Cloud Wampler, president of Carrier Corp., stated in a "year-end industry review."

The 1953 increase was double that shown by the industry in 1952, he pointed out.

Mr. Wampler said that the most significant areas of growth in 1953 were in year 'round air conditioning for homes and in large central systems for multi-story office buildings. He estimated that in the residential field sales of central equipment for entire homes increased some threefold (from 15,000 units in 1952 to nearly 50,000 units during 1953) and that sales of room air conditioners — of which he said about 75 percent are currently going into homes — more than doubled (from 412,000 in 1952 to close to a million in 1953.)

At the same time, a pronounced trend toward the complete central air conditioning of *existing* office buildings became apparent during 1953 in the nation's major cities, he said. This was on top of a continued demand for central systems for *new* office building construction.

Speaking for Carrier Corp., Mr. Wampler reported that its sales in all fields of air conditioning and refrigeration, including defense business, rose to about $165 million is fiscal 1953 — compared to a 1952 volume of about $108 million, and marking the fourth consecutive year of new sales records for Carrier.

"Overall sales results during 1953 strengthened my prediction that the 1950's will be the great growth decade for the air conditioning industry," Mr. Wampler stated. "The growth trends evidenced during 1953 can be expected to continue over the years to come and by 1962 total retail sales should reach the $5 billion mark," he predicted.

The majority of large, multi-story office structures built since World War II have included complete central air conditioning in their basic planning, he noted. Today, large numbers of existing buildings are installing central air conditioning as the most effective means of meeting the competition for first-class tenants and employees now developing in many cities as the result of recent, large-scale building construction, he said.

"Outside of residences and office buildings are the many industrial plants where air conditioning will become a competitive requirement in order to obtain the most efficient working conditions," Mr. Wampler pointed out. "This market represents the greatest single potential next to residential installations."

In addition, he said, the current evolution of new products and methods, such as synthetics of all types, together with high precision, virtually automatic manufacturing operations has created an even stronger need for air conditioning as a processing device.

"We have arrived at a period in this nation's history when virtually every structure — residential, commercial, or industrial — presents a demanding and increasingly immediate air conditioning opportunity. Nor can anyone sensibly say that a single type of equipment is the 'best' to handle this potential, since each situation requires its own most satisfactory and economic solution," he said.

"For the first time in our industry's development, we have a very large segment of the public using air conditioning, and expecting a great deal of it," he concluded. "We are laying our plans to exploit our full potential of more than a half-century of knowledge, experience and expanding facilities, so that the ever increasing number of users will not be disappointed."

Reports Big Gain in Orders for Room Units

NEXT SUMMER will be the coolest in history, Bernard A. Mitchell, president of the Mitchell Mfg. Co., predicts.

He bases his crystal-gazing on a four-week nationwide sales trip he recently completed. His firm received orders for 400,000 room air conditioners, twice the number placed last year during a similar series of sales meetings, he reports.

Mr. Mitchell estimates that only 3 percent of the country's homes and offices now have room air conditioners. He predicts that another 1½ million will be equipped with units before the end of next summer.

Record Aluminum Sales Expected in '54

THE YEAR 1954 promises to be a "selling year," the biggest in the aluminum industry's history, Richard S. Reynolds, Jr., president of the Reynolds Metals Co., predicts, because:

1) "The supply will be greater than ever before in the industry's history, assuring all consuming industries of adequate supplies.

2) "For the first time since the Korean war began, the year starts without any restrictions on civilian uses.

3) "With the major part of the expansion program begun three years ago completed, the aluminum industry has shifted its emphasis from increasing production to market development and increasing sales."

Careful Heating Analysis Can Lead to Savings

SMOKE prevention and financial savings can both be realized by realty owners and operators through careful analysis of their heating plant operation and smoke problems. A proper system, operating at the max-

imum possible efficiency, will produce less smoke than the maximum permitted under New York's new proposed stringent regulations, according to Murray Lieblich, vice president of H. Lieblich & Co., Inc., New York contractor.

By bringing a heating system up to date there are additional savings possible besides those of fuel costs, he points out. Old and obsolete systems usually require constant care and attention. In addition, maintenance and repair costs are higher because of the age of the system. Breakdowns are not uncommon and tenant relations suffer.

An analysis by his company of work performed by them within the past 25 years on commercial, industrial and apartment buildings reveals that despite changes in price levels, percentage savings have remained constant in conversion of heating plants. Savings of up to 50 percent and amortization of conversion costs within three years or less were the rule, according to the analysis.

Engineers' Council Reports Progress

ACHIEVEMENTS of the Engineers' Council for Professional Development last year, reflected in the ECPD's 21st annual report, include the following:

1) Good progress has been made with the project for providing counseling for high school boys interested in entering engineering, and while it cannot be said that it is being carried out at every high school in the United States and Canada, it is felt that this object may ultimately be obtained.

"Quote"

"Shortages of scientific and professional manpower always have qualitative as well as quantitative aspects. Consequently, an increase in the gross supply alone may provide no solution for a specific shortage. Two second-rate engineers are not a substitute for the one first-rate man required."—*From a report of the National Manpower Council, quoted in the annual report of the Engineers' Council for Professional Development.*

2) The training program for young engineers has actually started in Cincinnati, with some 280 students taking night classes. This is under the direction of Professor Cornelius Wandmacher.

3) It is hoped that the committee on student development will "awaken" university students to their professional responsibilities and the dignity of the profession.

4) There has been a wide distribution of ECPD publications through the information committee.

Record Heat Pump System for Florida Motel

THE 115 HEAT PUMPS for a $6½ million Miami motel-hotel represent the largest single installation of heat pumps on record, according to H. M. Brundage, manager of General Electric's heat pump department.

The motel project, called the Golden Gate development, is on Florida highway A1A. It will house 1500 people, contains a shopping center, play areas, and salt and fresh water pools.

Mechanical Contractors Supply, Inc., of Winter Park, handled the sale. Igor Polevitzky is the architect.

Heat pumps in multiple installation are proving particularly adaptable for motels because they switch from heating to cooling automatically, are easy to install and maintain, and because individual units can be turned off when the motel is partially occupied, according to Mr. Brundage.

Snow Melting Cost "Surprisingly Low"

SNOW MELTING systems are usually designed for a melting rate of 1 in. per hr of snow, according to the Plumbing and Heating Industries Bureau, although any desired rate may be provided for in the design.

The cost of operation, according to the bureau, is surprisingly low. It averages from $0.07 to $0.15 per 1000 sq ft per in. of snowfall. The cost of installing a snow melting system varies with local conditions and the area of surface and the amount of snowfall to be expected. A driveway 50 ft long might be equipped with a snow melting system for as little as $300, says the bureau.

Thus, the initial cost as well as the operating cost of a snow melting system is low when compared with the cost of manual labor and the hazards of manual snow removal, the bureau points out.

Big Increase in Shipments of Room Air Conditioners

SHIPMENTS OF room air conditioners for 1953 totalled about 1,075,000 units, compared with 365,451 units in 1952 — an increase of 194 percent — according to Geo. S. Jones, Jr., managing director of the Air-Conditioning and Refrigeration Institute.

Manufacturers' '53 shipments comprised 1,055,000 window sill type units and 20,000 console (floor type) units of 1½ hp and under, according to the ARI estimates.

Although room air conditioners have been sold for over 20 years, about 90 percent of all units have been sold in the last five years, he reported.

Radiant Heated Warehouse for One Whiskey Barrel

BONDED WAREHOUSES usually hold 50,000 or more barrels of aging whiskey. But the Albert B. Blanton distillery, Frankfort, Ky. can boast of a one-barrel-sized structure that has every feature of a regulation warehouse, including a special heating system.

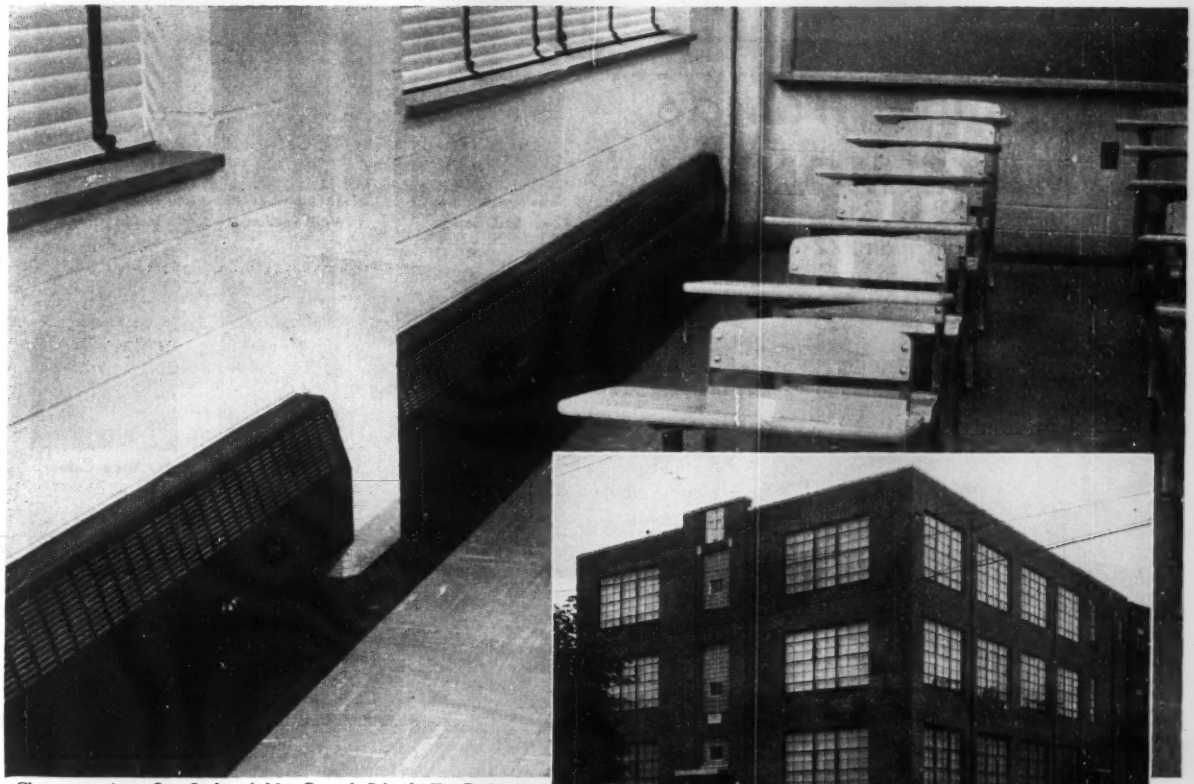
Consumer demand since repeal has meant the production of 2 million barrels of Kentucky bourbon at the home of Old Stagg whiskey. To honor this 2 millionth barrel, Schenley Industries, Inc., recently built the world's only one-barrel warehouse, which is radiant heated, at its Blanton distillery.

Standards for Steel Pipe and Fittings Need Correction

THE FOLLOWING ERRORS in the American Standard for Steel Pipe Flanges and Flanged Fittings, ASA B16.5-1953 have been brought to the attention of the publisher, The American Society of Mechanical Engineers. They are given here for the information of HPAC readers, as follows:

a) Page 55, Table 30, ¾ in. size. The dimension for the welding neck (in column 8) should be changed from 2 1/16 in. to 2¼ in.

b) Page 63, Table 36, ¾ in. size. The dimension for the length through the hub, lapped (in column 7) should be changed to read 1⅜ in.



Classroom view, Our Lady of Mt. Carmel School. Tru-Perimeter Heating with Webster Walvector. Sleeves in columns between windows simplify piping without loss of structural strength.

(At right) Our Lady of Mt. Carmel School, Camden, N. J. Floor space, 15,311 sq. ft. Construction cost (not including land, financial and legal expenses) $200,000. Heating cost, $14,580. Architects: Gleeson & Mulrooney, Philadelphia. Consulting Engineer: William G. Flurer, Upper Darby, Pa. Heating Contractor: Fred W. Schorpp, Inc., Camden.

11-Room School — $200,000

Gleeson & Mulrooney, Philadelphia school architects, designed this three-story school building, completed in 1953 at a cost of $13.10 per square foot. The bright, appealing classrooms accommodate 650 pupils. High windows assure ample light and air.

Economy in first cost was aided by the simplified exterior and absence of unnecessary frills. Nevertheless, the building has such features as slate sills, vermin-proof walls, ventilated clothes closets and well lighted corridors. And the complete Webster Tru-Perimeter Heating System with Webster Moderator Control required less than 7½ per cent of the construction cost.

Webster Walvector spreads the heat evenly along the perimeter of the building, blankets the large window areas, takes no usable floor space. Low pressure steam is under Webster EH-10 Moderator Control, which varies heating automatically with changes in outdoor temperature . . . provides manually for quick heating of rooms when classes arrive, reduction of heat when they leave. Steam circulation is facilitated with Webster Traps, Valves and Webster Double Service Valves. The rugged, single-unit Webster Moderator Control involves minimum maintenance cost — no blowers or fans, no buried or inaccessible piping.

For money saving on school heating, look into Tru-Perimeter Heating with Webster Walvector and Webster Moderator Control. Call the Webster Representative, or write us.

Address Dept. HP-2

WARREN WEBSTER & COMPANY

Camden 5, N. J., Representatives in Principal U. S. Cities

In Canada, Darling Brothers, Limited, Montreal

Webster WALVECTOR

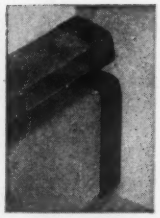
REG. U. S. PAT. OFF.

For Steam or Hot Water Heating

How to win friends and **MAKE MONEY**

Send for Publication 272

End Cap

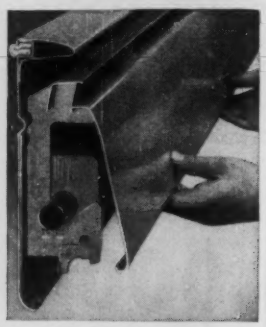

Wall Section

Inside Corner

Damper

Outside Corner

Joint Trim



Support Bracket

NESBITT

Baseboard Radiation

When you have snapped the last front panel into place and have trimmed out with accessories, your installation of Nesbitt Baseboard Radiation is complete and you have accomplished four things: First, you have had as much fun as a kid putting together the fitted parts of a prefabricated toy. Second, with the least possible exertion and in record time you have provided a high capacity system of perimeter convector-radiation along exposed walls. Third, you have assured the full-zone comfort and contemporary beauty that makes customers friends. And fourth, you have made a quick profit.

Where other manufacturers of "baseboard" left off, Nesbitt began to make a really effective space heater with four square feet of radiation per lineal foot of corrugated fin element—adequate for one-wall performance in most rooms—and housed in a beautiful slim enclosure. Nesbitt tooled a large factory area to produce this product at the lowest cost in standard nominal lengths of four, six and eight feet—with every labor-saving provision and needed accessory—for you!

Approved I=B=R Ratings

All leading makes of BASEBOARD have *something*—but *something* is not enough when NESBITT gives you *everything*!

MADE BY JOHN J. NESBITT, INC., PHILADELPHIA 36, PA. • SOLD EXCLUSIVELY THROUGH PLUMBING AND HEATING WHOLESALERS

"OPEN FOR DISCUSSION"

WE FOLLOW HERE each month the practice at engineering society meetings of providing an "open for discussion" period. You are urged to take part. Just address your comments to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

BILL DOPP —

"Con Fuzed Really Gets Things Confused"

THE SOLUTIONS offered by Con Fuzed in the December HPAC to Mac's piping problem in the July HPAC — It Looked So Simple — raise some more interesting questions.

If we look back to the situation as Mac found it, we find that Herman had already installed the new line and that Mac was trying to get him out of his difficulty as inexpensively as possible. He did tell Herman that he should have gone to an experienced consulting engineer before trying to rearrange that line.

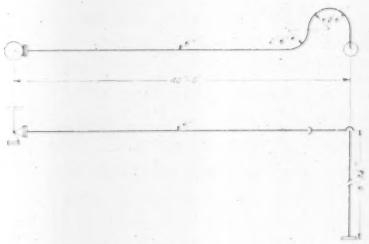
Now Con Fuzed suggests that the engineer would have completely redesigned the line by simply adding a few pipe bends. He says he happens to like pipe bends but realizes that even a little more flexibility might be obtained by using straight pipe and welding ells to follow either of the contours shown in Figs. 1 and 2.

We must concede at once that he has increased the flexibility in Fig. 1 by adding 2 ft-6 in. to the vertical beam. Had he used welding ells instead of pipe bends he would have added approximately 5 ft to that length and reduced the stresses to a negligible amount. If he has assumed, as L. E. Partch has in his article Calculating Flexibility in the December HPAC, that in this "straight line element" system circular arcs are considered as a series of straight lengths, anyone who has had experience with quarter bends anchored at both ends will question his assumption. In my opinion, it is the adjacent straight lengths that give them the little value that they have.

However, when Con Fuzed turns his bends sideways, he really gets things confused. Then, the value of his 2ft-6in. addition to the length is immediately lost. Here he has introduced into the problem an element of torsion that did not exist previously. If Mr. Partch is correct in his analysis, this additional stress becomes important — particularly in a borderline case such as the one under discussion.

I think that our friend P. I. Ping, would agree that the first suggestion does improve the design. What does he think of the second suggestion?

1 THE FIRST alternative would consist of a quarter and "U" bend



2 A SECOND solution might be installed this way

It would be interesting to see, too, how the Task Force would handle this second idea as presented by Con Fuzed. Mac said in the first place that it wasn't as simple as it looked. It was Herman's idea that it looked so simple. — BILL DOPP.

G. W. HAUCK —

"Would Like to Amplify Article on Steam Piping"

I ENJOYED READING the article, Steam Piping Must Be Drained, in the January HPAC. Some thoughts occurred to me, however, which may be of interest to others.

The article recommends that for large equipment — such as turbines and engines — it is advisable to install trapped separators in the steam lines. This statement might be amplified by suggesting that in many such instances the use of receiver type steam separators is advisable. This is particularly true for steam supply lines to engines.

Receiver type steam separators will do more than remove the condensate. When they are properly sized as to capacity, they provide a reservoir of steam near the throttle inlet of the engines and thus prevent pulsations in the flow of steam in the connected steam piping.

The matter of adequate drains for boiler non-return valves and header valves deals with another important phase of the subject. It is important enough to include the following amplification from the ASME Code for Power Boilers. It is very explicit about adequate drainage of condensate in a paragraph which is quoted as follows:

"When boilers are connected to a common steam main, the steam connection from each boiler shall be fitted with two stop valves having an ample free blow drain between them. The discharge of this drain shall be visible to the operator while manipulating the valve."

The advantages of an ample free blow drain and proper visibility of discharge, plus trained operators are obvious in considering safe operating techniques. Whenever the contour of boiler piping will permit condensate to form above the boiler non-return valve or above the header valve after a shutdown, then free blow drains should be installed on both valves. — G. W. HAUCK, Manager, Engineering Sales, Crane Co.

G. L. TUVE —

"A Little Imagination Will Overcome Drafts"

YOUR ARTICLE on delivering air to press rooms, by F. F. Stevenson, in the September HPAC, shows how much can be gained by a little bold design of air distribution systems. The author has demonstrated clearly how to overcome the disadvantages of a long, continuous air discharge slot. In the first place he used a tapered duct as recommended by Koestel in the ASHVE Journal Section of the July 1951 HPAC to produce a uniform outlet velocity and angle throughout the length of the slot. Then he widened the angular spread of the stream, not only by discharging through a V-shaped perforated plate, but also by utilizing

the tendency of a horizontal jet to adhere to the ceiling or duct wall. This further confirms the results given in my paper in the ASHVE Journal Section of the January 1953 HPAC. For short throw and high induction, the advantages of a wide-spreading jet which are shown in Table 2, p. 119 of the ASHVE Journal Section of the July 1950 HPAC, were combined with those of a perforated plate and given in Table 1, p. 183 of the ASHVE Journal Section of the January 1953 HPAC.

Design formulas for computing the characteristics of the air stream in the room are given in the references cited, and it is to be hoped that more designers will be encouraged by Mr. Stevenson's success. A little imagination in meeting such special conditions will gradually overcome the public's distrust of "drafty" air conditioning.—G. L. TUVE, Professor of Mechanical Engineering, Case Institute of Technology.

A. WALTON —

"Architect for Cathedral Not Given in Article"

In my article entitled Floor Panels, Units, Central Systems Heat, Ventilate Cathedral in the December HPAC, the architect's name should have been included. He is Paul C. Reilly, New York. — A. WALTON, Sears & Kopf, A. Walton, Associate, Consulting Engineers.

ROBERT E. PARKER —

"Sound Levels Are Difficult to Measure"

I WOULD LIKE to comment upon the article, Facts About Sound Levels for Axial and Propeller Fans, which appeared in the October HPAC.

We have often had customers who ask for the sound level of a propeller fan for the case of operation against a specified resistance. We must then point out that the NAFM code sound level determination for a propeller fan applies only for the case of the fan operating in free air, and that the result has value only for comparative purposes. No method of determination is given for the condition of operation against resistance, as this is a problem of considerable complication and would undoubtedly require a much larger plenum chamber for the control of static pressure than the code now specifies for the air test. It was noted in an article entitled Fan Noise Level — What Does It Mean? by R. A. Gerlitz in the June '51 HPAC that a wall mounted fan seems quieter within a room when exhausting than when supplying air, so that such a determination would be different in each case.

Aside from types of sound level code determinations and their value, either as relative or absolute measurements, there is a certain variability that may be possible in a given type of determination for a given fan which should be mentioned. This variability can be due to the fact that two sound level meters with over-all free-field frequency response characteristics which lie within the tolerances specified in the American Standards Association Bulletin Z24.3-1944 may still read four decibels different at the same point in the same sound field, even for a broad band sound. Actually, however, some instruments can be calibrated to high accuracy at a definite frequency by a special calibrator which, when placed in a fixed acoustic coupling with the microphone, calibrates the entire system including any cable which might be used. Accurate response at other frequencies then depends on the shape of the frequency.

The ventilating engineer sees little value in present sound code determinations, as these tell him almost nothing. The success of his installation depends on the acceptability of the sound which finally reaches the ventilated space, and it is obvious that in order to predetermine this in a rational manner, complete information about the sound in the outlet of the fan must be available. Knowing this and the criteria for permissible sound levels, as well as grille and room characteristics, the design of the duct system can then proceed. As it is mentioned in the article, one of the factors which delayed the development of a code for the determination of fan outlet noise was a suitable microphone for measurement of sound in an air stream of appreciable velocity which would not transmit a rumble from air velocity alone.

Work which has thus far been completed in this direction by one group is reported in an article entitled Apparatus and Procedures for Predicting Ventilation System Noise, by L. L. Beranek, J. L. Reynolds, and K. E. Wilson in The Journal of the Acoustical Society of America, March 1953. A system is recommended in this article which is suitable for the measurement of the outlet sound and represents a step towards the development of such a code.

A companion article in the same issue entitled Noise of Ventilating Fans, by C. F. Peistrup and J. E. Wesler, shows typical results obtained in the fan outlet as plots of power level in decibels versus frequency for three vaneaxial fans and two centrifugal fans. Also, a formula is given for the conversion of sound pressure level in the duct to power level. The power level spectrum existing at the room outlet is that measured in the fan outlet modified by the attenuation of the duct and its treatments, if any, and the grille. The power level is then used for the computation of the sound pressure level at a particular point in the room, and this is affected by outlet location, distance and direction from the outlet, surface area of the room, and absorption coefficients for those surfaces.

These final remarks are merely a simplified description of the presently proposed use of sound measurements in outlet ducts of fans, but our present concern is directed mainly towards the development of a code which will provide a reliable technique for fan manufacturers to follow in obtaining sound measurements in fan outlets. — ROBERT E. PARKER, Director of Research, Ilg Electric Ventilating Co.

E. H. DAFTER —

"C. T. Baker Is To Be Congratulated on His Article"

C. T. BAKER is certainly to be congratulated upon his article published in the November HPAC.

As Mr. Baker points out, it is too often that the buyer himself is largely responsible for poor air conditioning installations, because he buys on "price".

Again, too many plans and specifications that are not complete are issued, and there are too many instances where the buyer buys on price and not on the reputation of the contractor. The illustrations given are very much to the point.

If reprints are available of this article, the writer would certainly like to have a half a dozen or so.—E. H. DAFTER, Carrier Corp.

"OVER 10,000 Satisfied Maryland Home Owners Attest to the Outstanding Qualities of REVERE COPPER WATER TUBE—"

Says, Anthony W. Keene, President, ANTHONY W. KEENE, INC., Heating & Plumbing Contractors, Baltimore, Md.

"I've been operating in the Baltimore area for over eighteen years," said Mr. Keene. "Typical of the 10,000 units in which I have installed Revere Copper Water Tube is the Meadow Lane development which you see on the wall of my office. I have worked with various builders and they have told me they wouldn't specify anything but enduring copper water tube for plumbing lines . . . no rustable materials for them. Not only that; copper is easy to bend, needs no threaded fittings so naturally we can hold down our installation costs. Ever since I have been in business I have used Revere Copper Water Tube and have never regretted one foot of it."

Keep out of trouble with copper . . . guard *your* reputation for quality work. Use enduring Revere Copper Water Tube. There's a Revere Distributor near you who carries a full stock in both hard and soft tempers. And, if you have technical problems, he will put you in touch with Revere's Technical Advisory Service.

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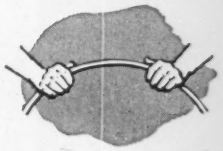
WHY REVERE COPPER WATER TUBE IS PREFERRED BY—

Architects, Builders, Plumbing & Heating Contractors



EASY TO BEND

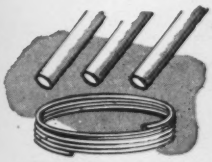
Saves Time

Revere Copper Water Tube is easy to bend. Soft temper can be bent by hand to meet installation conditions.

HANDY LENGTHS

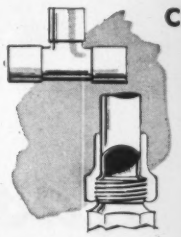
Save Fittings . . . Labor

Revere Copper Water Tube comes in straight lengths of 20' in hard and soft tempers. 60' coils of soft temper reduce the number of fittings needed.



SOLDER OR COMPRESSION FITTINGS

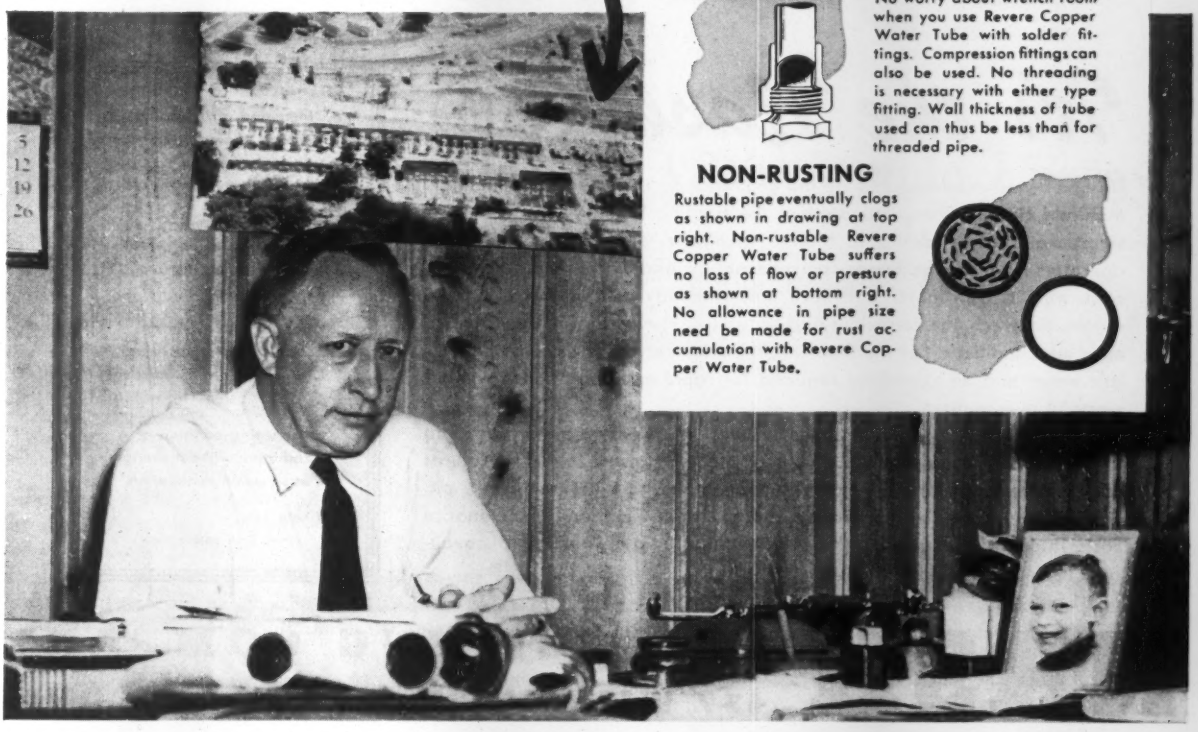
Need Less Work Room . . . Save Metal



No worry about wrench room when you use Revere Copper Water Tube with solder fittings. Compression fittings can also be used. No threading is necessary with either type fitting. Wall thickness of tube used can thus be less than for threaded pipe.

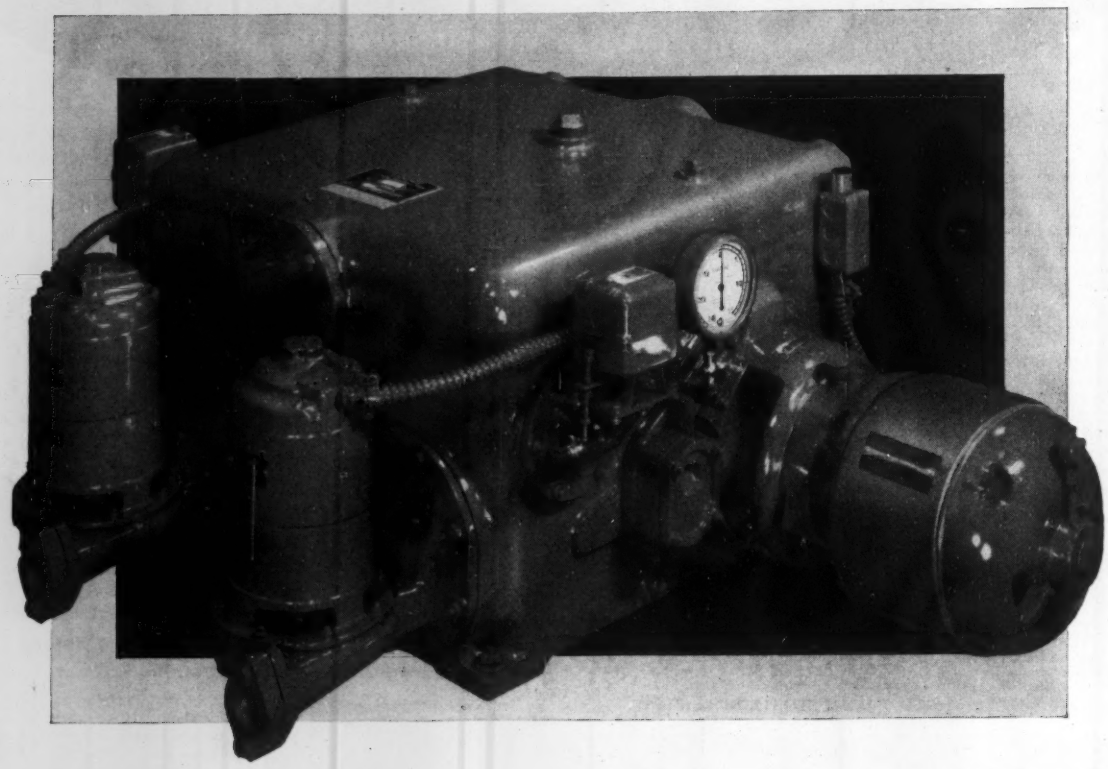
NON-RUSTING

Rustable pipe eventually clogs as shown in drawing at top right. Non-rustable Revere Copper Water Tube suffers no loss of flow or pressure as shown at bottom right. No allowance in pipe size need be made for rust accumulation with Revere Copper Water Tube.



THIS NEW VACUUM HEATING PUMP

HAS THE INCREASED AIR CAPACITY EFFICIENT HEATING PRACTICE DEMANDS



It's the Nash CSM

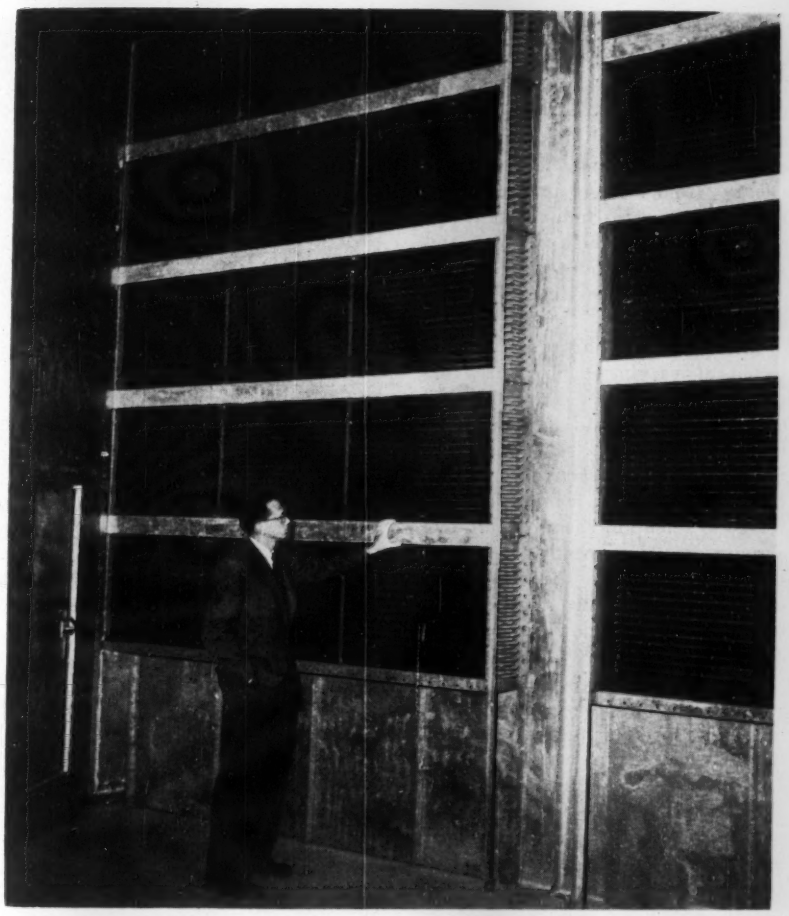
Designed and manufactured by the organization that made the Jennings Manifold Heating Pump standard of the Heating Industry, the new CSM incorporates every desirable feature architects, engineers, owners and operators have sought. Employing separate air and water pump elements, each with its own motor and each independently controlled by its own automatic switch, the capacities and arrangement may be widely varied to meet job conditions. For the first time, the engineer has the choice of realistic water and air capacities required for rapid system response without wasteful overheating.

These pumps possess many other features which permit a more efficient utilization of fuel and minimum use of electric power. Low, low returns reduce installation costs and usually eliminate putting the pump in a pit. Simplicity and efficient operation reduce supervision and maintenance costs. Information regarding this new heating pump development is available immediately upon request.

- Increased air capacity induces rapid system response without wasteful overheating.
- Separate air and water pumps individually selected to meet actual job requirements.
- Control system that operates individual pumps only when needed.
- Flexibility permitting addition of radiation without changing basic pump installation.
- Low, low, return line connection.

NASH ENGINEERING COMPANY
437 WILSON, SO. NORWALK, CONN.

• One of the first systems to utilize the heat from atomic reactors for space heating is described. More than 10,000 gpm of reactor effluent is pumped through the primary heat exchanger in order to produce the required temperature rise in the secondary stream flow of 4500 gpm. The piping is all underground and uninsulated since the heat source is abundant and at sufficiently low temperatures to make the losses to the ground negligible. 168,000 cfm of outdoor air is admitted continuously through preheater coils, filters and air washers for ventilation purposes.



THE RELATIVE SIZE of the installation is shown by these four pass reheater coils in place

Heating With Atomic Energy

How Atomic Reactors Furnish Space Heating at the Big Hanford Works

By Robert T. Jaske
Hanford Atomic Products Operation
General Electric Co.

SINCE THE FIRST Hanford production reactor became an operating reality in September 1944, the thoughts of most engineers in the atomic field have always turned toward eventual use of this production tool as a primary power source. Countless billions of Btu's have been dissipated in the cold clear water of the Columbia river. In the midst of a Northwest power shortage, this situation opens an even more challenging vista, the eventual solution of which still lies in the future.

Recent announcements indicate that industrial power from the atom is in the near future—perhaps within five years. The heat recovery system currently being installed as part of a plant expansion at Hanford might be considered as an infant step on the way to the realization of this power goal. The facet of its infancy makes it no less interesting to engineers in the heating and air conditioning field, since it represents a unique combination of standard equipment and a well coordinated engineering effort.

Ventilation Air Required

The problem begins in the atomic field itself. The operation of huge production reactors produces incipient leakage of small amounts of radioactive gases and particles from these units, resulting in the need for large quantities of ventilation air in order to keep radioactive concentrations down to safe limits. As much as 175,000 cfm of outdoor air has been used in some of the reactor process buildings, representing an annual fuel bill of large magnitude. Considerable development effort is being devoted to minimizing these costs by careful design of process equipment.

The use of reactor effluent is a logical step in this economic picture, and this step was taken. The system is expected to save $59,000 in annual fuel costs and will be completely paid for from the savings in about seven and one-half years.

Water Must Be Treated

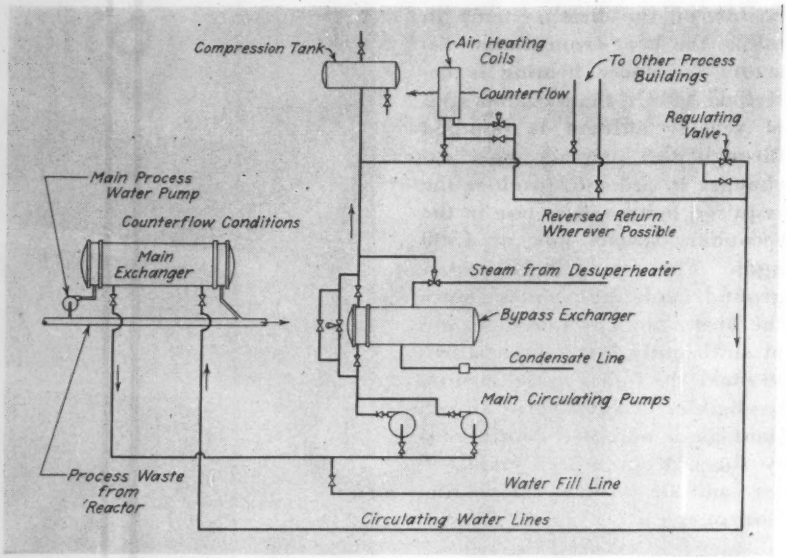
Atomic production reactors require large volumes of carefully treated water to cool the fuel elements in the transmutation process. This heat originates in the absorption of kinetic energy from fission products and the energy in other radioactive forms such as alpha and beta particles and gamma photons produced by fission. This heat is then exchanged to the cooling system.

The spent cooling water is rejected at varying temperatures depending on the inlet conditions and the power level, and discharged to the effluent system. Since the water itself becomes radioactive in passing through the reactor, it must be transferred to retention basins, where this activity is significantly decreased before discharge to the river. All operations are rigidly controlled in order to minimize downstream river contamination.

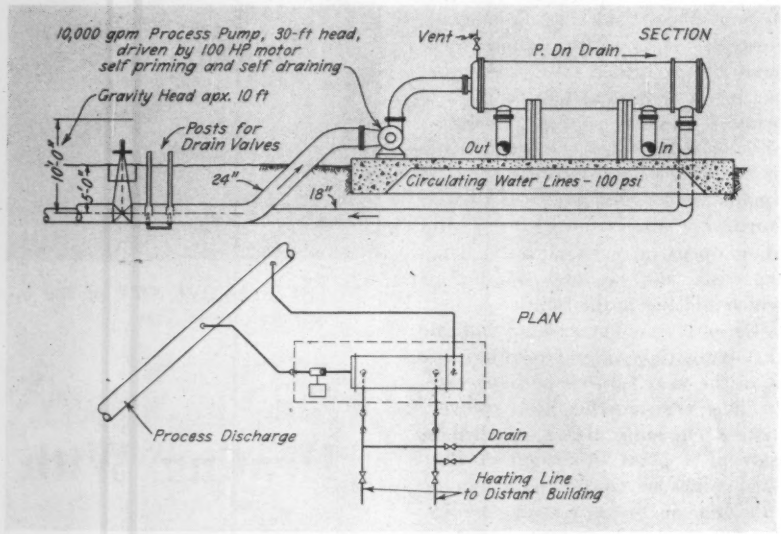
Combining the elements into a workable system proved to be a large task—as large as the heating load of 50,000,000 Btu would indicate. Due to water temperature variations, the system had to be flexible enough to handle extremes of weather and water temperature conditions. This required the use of a parallel steam heated exchanger which would be available at all times.

All of the essential elements of the final design are shown in Fig. 1. Water from the effluent line is pumped into the primary exchanger, where its counter flow passage warms the secondary circulating fluid which is subsequently routed to the various process buildings—for exchange to air through the medium of central systems, unit heaters and unit ventilators. Providing the necessary flexibility, a secondary heat exchanger receiving energy from steam boilers parallels the effluent heat exchanger, although remotely located. This permits essentially independent operation of the ventilation system, which is necessary because of the need for full ventilation even during plant shutdown for discharge of fuel and maintenance.

One of the requirements imposed by the use of low temperature water is the use of anti-freeze solution in the secondary circuit. A 35 percent ethylene glycol solution protecting against temperatures of below



1 THIS FLOW DIAGRAM for the heat recovery system shows the main components and what happens in the fluid flow processes



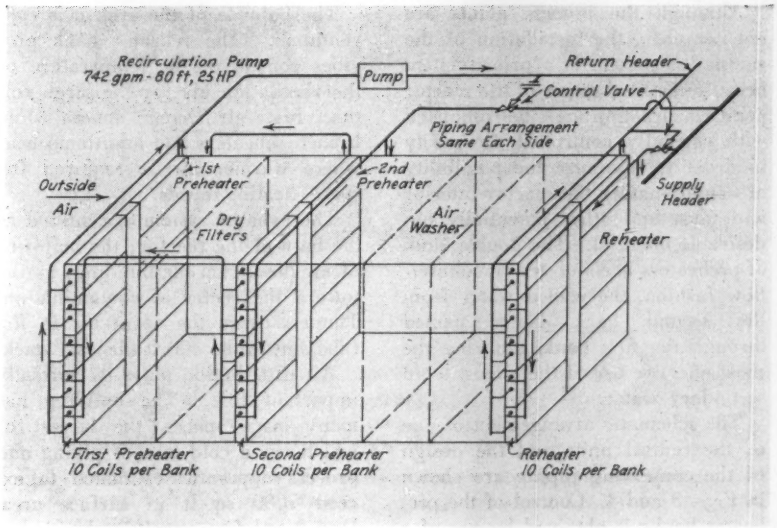
2 THE GENERAL ARRANGEMENT of the heat recovery unit is shown here. The unit is outdoors and uninsulated

0 F has been specified. Other solutions such as methanol were ruled out by the safety hazard potentially present to so important an installation. Several thousand gallons are required, which is perhaps the largest amount ever used for this purpose.

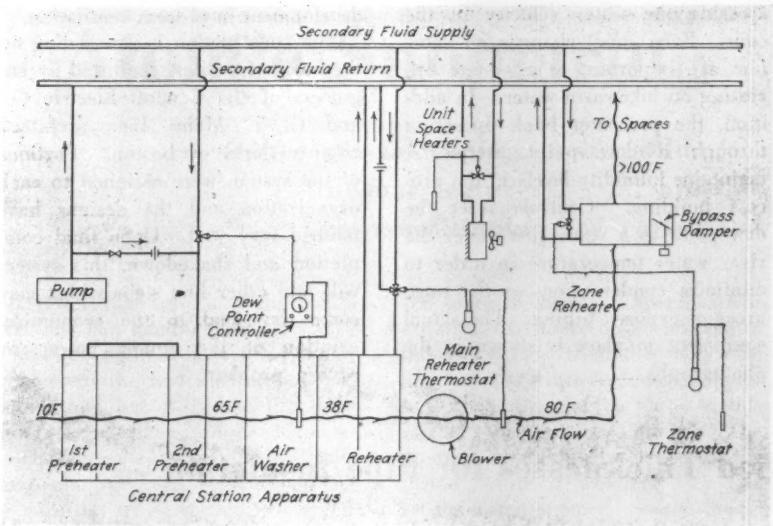
Network of Piping

A network of piping connects the various process buildings with the primary and secondary exchangers. This piping is all underground and uninsulated since the primary heat source is both abundant enough, and at sufficiently low temperature to make losses to the ground negligible. The underground portion of the network is not used when the heating plant is operating on steam—distribution being through process utility tunnels.

Direct burial of the piping from the primary exchanger to the distribution area permitted a considerable saving. Almost 2000 ft of line are involved in the circuit. The glacial rubble which makes up all of the subsoil in the Hanford area drains readily and offers favorable conditions for burial of uninsulated



3 THE PIPING ARRANGEMENT for one of the 84,000 cfm central station units is designed to accommodate and control the outdoor air admitted for ventilation purposes



4 THE EQUIPMENT AND CONTROLS are arranged so as to obtain the desired conditions of the ventilation air and for space heating

piping. This item alone, considering the alternate course of using protected conduit or tunnel type construction, saved over $100,000. Depending on the degree saturation of the soil, temperature drops or losses are predicted to be in the 2 to 4 F range. The piping is of all welded construction. Sufficient offsets in the route of the lines have eliminated the need for special expansion joints.

Reactor Equipment Is Large

The equipment is large by any standards. The plant heat load is 50,000,000 Btu per hr at the design temperature of −10 F. This load is divided among the various process buildings, the largest of which requires about 50 percent of the entire load. More than 10,000 gpm of effluent is pumped through the primary exchanger in order to produce the required temperature rise in the secondary stream flow of 4500 gpm.

The primary exchanger is a two-pass shell and tube type containing more than 30,000 sq ft of heat transfer surface. This unit, which measures 20 ft long and 10 ft in diameter, uses 3000 tubes. The arrangement of the primary exchanger, the piping and pump for circulation of the primary effluent stream is shown in Fig. 2. Note that the arrangement is outdoors and is uninsulated.

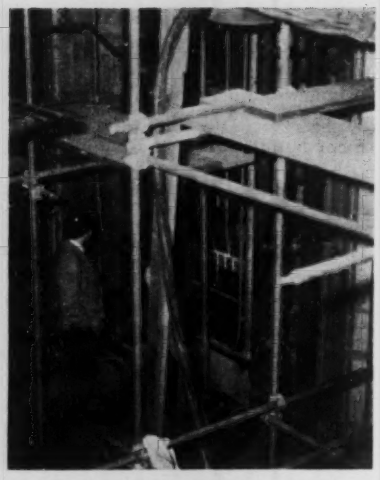
Area To Be Protected

Due to the presence of the radioactive effluent stream, the entire area surrounding the exchanger will be closed off. Based on the volume of water contained in the unit described, the radiation level is expected to be about 500 mr per hr at a distance of 1 ft, or less than 1 mr per hr at a distance of 50 ft. This latter value is currently conceded as being a normal design target for continuously occupied spaces, while the former value is 80 times the current radiation level permissible for an 8 hr day permitted at the Hanford atomic products operation.

No shielding provisions are made. Protection for personnel will consist of a barricade fence, suitably identified, located at a distance of 50 to 75 ft from the exchanger. Some concern was originally expressed regarding possible mixing of the two streams due to possible tube failure, resulting in contamination of the secondary fluid. However, the pressure maintained in the secondary system will always exceed that of the effluent system and flow from any leaks would be outward from the secondary system. Careful attention has been devoted to the selection of materials in order to minimize potential leakage losses of valuable anti-freeze solution.

168,000 Cfm of Outdoor Air

Several features of the ventilation equipment make the installation in the reactor building especially worthy of comment. As stated previously, the operation of the reactor releases a small amount of radioactive matter to the air. The continuous dilution of this potential hazard is the major function of the air distribution system. Failure would cause complete shutdown of the entire reactor plant and subsequent losses of plutonium production. For this reason, two parallel sets of central station equipment feeding a common distribution system and connected to a dampered casing are used. Each unit is capable of handling 84,000 cfm—all outdoor air—totalling 168,000 cfm.



THE AUTHOR examines the recirculation pump and the central station equipment under construction

Should either one of the coil banks or air washers fail, the two fans can produce a flow of 140,000 cfm in the remaining unit at a 10 percent penalty in temperature conditions. Each of the fans is capable of handling the entire flow of 168,000 cfm—control for regular operation is obtained by the use of inlet dampers. Each central station unit consists of two banks of preheater coils with air mat type filters in between the banks, a capillary air washer, reheater bank and the blower. The latter requires a 200 hp motor at full load and uses V belts.

Although the process plants are not complete, the installation of the ventilation system is a priority item because the final stages of the reactor plant construction must be completed with carefully controlled air purity in order to minimize the possibility of contaminating the reactor interior with dust and other potentially undesirable material. The double bank of preheaters is connected in counterflow fashion, the cooled water from the second bank being passed through the first bank, allowing the most effective use of the almost tepid secondary water.

The schematic arrangement of one of the central units and the design of the connecting piping are shown in Figs. 3 and 4. Control of the preheater banks is obtained by use of a recirculation pump which permits a three way valve to regulate the water flow through the coils without upsetting the flow distribution or decreasing the water velocity in the coils. Even small changes in water film are important to a system operating on lukewarm water. In addition, the preheater bank operating through a dew point thermostat maintains humidity levels in the process building. Controls reset the dew point to a value just under the river water temperature in order to minimize condensation on the huge areas of exposed piping. The actual equipment in place is shown in the photographs.

The balance of the system is conventional. The reheater bank provides control of the temperature of the ventilation air for the large volume, high air change spaces while branch reheaters add additional heat where warmer air is required for space heating needs.

The exhaust system is centered in the base of the reactor; the majority of air flow from the buildings moves toward the center of contamination. Tunnels carry the spent air to the fans and to the 300 ft disposal stack.

Air distribution plays its normally important role. The building has many large spaces, the largest of which has a cold face of piping and process apparatus estimated to exceed 7000 sq ft in surface area. Downward free gravity velocities of 130 to 150 fpm are reached under these conditions at the bottom of the wall, and effective control of this one problem represents a long development in process ventilation.

The construction is proceeding on the basis of designs produced by engineers of the General Electric Co. and C. T. Main, Inc., architect-engineer firm of Boston. Portions of the system were assigned to each organization and the designs have meshed very well. Upon final completion and shakedown, this system will join other first steps which may some day lead to the economical solution of the atomic power recovery problem.

Adopt Simplified Thicknesses for Pipe Insulation

PRODUCERS OF 85 percent magnesia and diatomaceous silica insulations have adopted new simplified thicknesses for pipe insulation to aid specification writing and permit the use of all sizes and thicknesses in double layer construction, according to Marshall F. Allen, manager of The Magnesia Insulation Manufacturers Association, 1317 F St., N.W., Washington 4, D.C.

While this is in effect a "standardization" procedure, it does away with the old so-called "standard" and "double standard" thickness terminology which has been in use for many years but which has lost its significance under modern economic conditions. Furthermore, different manufacturers have produced 85 percent magnesia in varying thicknesses, while under the new system all magnesia and diatomaceous silica pipe insulations will conform to the new table.

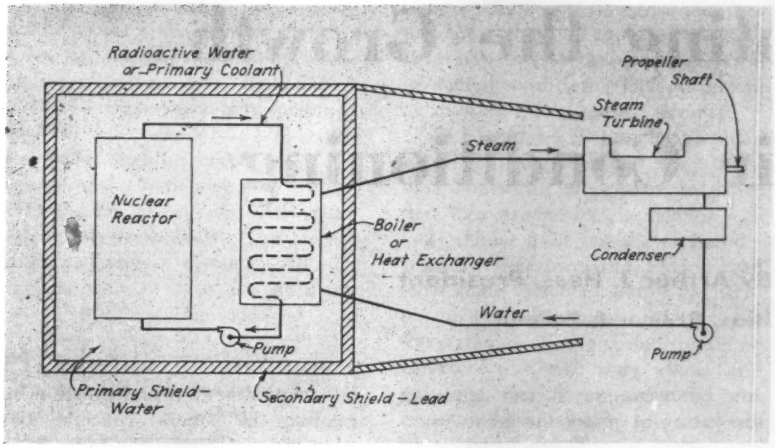
The nominal thicknesses start with 1 in. and step up by ½ in. increments. Actual thicknesses will depart slightly from the nominal thicknesses to facilitate double layer construction. Specification writers may specify in nominal inches with the assurance that actual thicknesses will conform to the table regardless of the source of the material. Critical engineering calculations should employ the actual thicknesses, Mr. Allen says.

A complete conversion table covering all insulation thicknesses for all pipe sizes can be obtained from the MIMA.

Taking insulation for a 1 in. pipe size as a typical instance, a comparison of the old and new thicknesses is as follows:

New nominal thicknesses, in.	1	1 1/2	—	2	2 1/2	3
New actual thicknesses, in.	1 3/32	1 19/32	—	2 1/8	2 21/32	3 5/32
Obsolete thicknesses, in.	7/8	1 1/2s	1 29/32ds	2	2 1/2	3

s — designated "standard"
ds — designated "double standard"



THE COMPONENT parts of the system and the principle of operation are illustrated here very generally

Launch First Atomic Submarine

It has special piping, many other unusual features . . . . and air conditioning, of course

WITH THE LAUNCHING of the U.S.S. Nautilus last month, the U. S. Navy embarked upon a new era. This is not only the first nuclear powered submarine, but it is one that contains many other unique features.

The complete technical details have not yet been released on account of security reasons. However, some information on the power plant and piping has been made available.

Power Plant and Piping

The propeller shaft is driven by a steam turbine which receives steam from the boiler that is supplied its energy from the reactor. The accompanying diagram illustrates very generally the component parts of the system and the principle of operation. The piping is of stainless steel with welded joints and is 1½ in. in diameter, with extra thick walls.

In one of the tests conducted on this piping, depth charges were detonated at a distance of 30 to 40 ft away to determine the resistance of the pipes to shock. Specifications required that there be no leakage in the closed loop from the reactor to the boiler — this includes the piping, the piping joints, pump glands and all other possible sources. The piping had to have a bright polish inside before it was put into use, as the smallest speck would create havoc in the working system. In order to meet these requirements, many problems had to be solved — one of which was the development of an entirely new type of pump to be positively sure that no leakage would be experienced. Of course, leakage of radioactive liquids into the submarine would be intolerable.

The Nautilus will be the biggest submarine that the Navy has had beneath the surface since the last war. Recreation rooms, mess compartments and living spaces are provided that compare favorably with such spaces and conveniences found on large surface vessels.

The mess compartment found in old submarines doubled as movie hall, recreation room, for letter writing and mess cook working space. The Nautilus will have a messing compartment that is exclusively an eating place — with room to move around in besides. The new Nautilus will also have two decks and accommodation ladders with enough room for men to pass going up and down. A small machine shop, sick bay, and a laboratory are in the after torpedo room.

Air Conditioning Provided

The wardroom stewards will gain, too. Instead of carrying food for the officers half the length of the ship and ducking through watertight doors, they will have the food delivered to them by a dumbwaiter from the galley on a lower deck level. Air purification and oxygen replenishment equipment will keep the air clean and proper for breathing. Air conditioning equipment is installed to provide comfort for the crew. All of these convenience and comfort features have been added to increase the human endurance of the crew, which is expected to be the only limiting factor to the cruising range of the new Nautilus.

Painting and lighting will also have a favorable psychological effect on the crew. Living spaces are painted with light colors, which is expected to eliminate the "closed-in" feeling experienced with cramped quarters. The lighting is fluorescent and spotlighted on the gages and other operating instruments.

The designers of the Nautilus were fortunate in having this additional space in which to include these extra features. This was all made possible as a result of the increased diameter of the Nautilus hull. It was necessary to use this larger diameter in order to house the nuclear plant.

Although radically different inside, the exterior of the Nautilus is not very much different from the old submarines, except for size. Pear shaped and streamlined, she has a bulb nose that decreases her surface speed, but allows greater underwater speed. This increased submerged speed is aided by the streamlining which eliminates or makes retractable all topside protrusions. Also, when completely surrounded by water, there is less resistance.

— HOWARD S. DEWEY

Promoting the Growth of Air Conditioning

By Arthur J. Hess, President
Hess, Greiner & Polland

THE AUTHOR, Arthur J. Hess, is the recently elected national president of the American Society of Refrigerating Engineers. He is also most active in the American Society of Heating and Ventilating Engineers, and is a new member of the ASHVE's council

• In a rapidly growing industry — such as air conditioning — it is well to remember on occasion that there is usually a minority of the public still to be convinced of the advantages it offers. Criticisms of specific air conditioning installations are often unjustified. Every operator of a large air conditioning installation has probably had his troubles trying to satisfy those whom he comes to regard as "chronic kickers."

But in some cases, such criticism is well-founded. In his comments here, Mr. Hess tries to separate some of the wheat from some of the chaff, and to indicate what the industry might do to assure the continued growth and even more general public acceptance of air conditioning's benefits.

AIR CONDITIONING is fast attaining the stature of one of the great American industries. The industry is on the march — and a rapid march it is — to greater and greater growth and usage.

How is this possible, when some people "don't like air conditioning"? Perhaps the answer is obvious: If many people did not like air conditioning, it could not possibly grow as it has. In other words, the great majority of those who enjoy the comforts of an air conditioned environment may say very little about it — but show their approval by patronizing air conditioned places of business, demanding air conditioned work spaces, and purchasing air conditioning for their homes.

The malcontented minority is critical and vociferous enough to create — sometimes — an illusion of general discontent with comfort conditions as produced by air conditioning systems. However, it is often estimated that this minority group is less than 20 percent of the people who have experienced air conditioning. A study of the problem brings to light some interesting observations.

"I don't like air conditioning — and I only installed it in my building because it seemed necessary in order to rent the space profitably." So said a prominent businessman to the air conditioning consultant on the building in question. The dissatisfaction of this building owner and operator shocked my friend, the consultant, who thought he had designed a good installation. It also set me wondering why so inconsistent a statement could be made by a man who had just invested over $100,000 in an air conditioning system for his building.

Exploration of this problem disclosed an amazing hodge-podge of information and misinformation regarding the general conception of what air conditioning is and what it can and should accomplish. Though the reactions of all are important and will be the objective of this presentation, that of the layman was most interesting.

Laymen Must Be "Educated"

Contrary to the general industry belief, the layman was not waiting for air conditioning with bated breath, but had — and in many cases still has — to be educated to it. Many persons today (especially men) still cling to the old Spartan belief that discomfort without complaint proves virile manhood and superior physical power. Many a man has acknowledged air conditioning as a benefit only after his wife or his feminine office force has insisted on an installation. Practical women see no value in being uncomfortable as compared to bragging that one can stand discomfort. The Spartans will always have a cult and some of them will choose air conditioning as the villain in their campaign against change.

A similar group of "the opposition" comprises the nature worshipers who believe that conditions of living as supplied by nature are better for mankind than any we can manufacture with machines. This group will undoubtedly approve of air conditioning ultimately but will always object to the latest developments in the art. Of course, this means that they will always be dissatisfied with the product of the moment.

One of the principal problems in the air conditioning industry has to do with the differences in clothing worn by men as compared with women. It is well known to all of us

that the ladies have been smart enough to set a standard of clothing to best circumvent the weather, while the hide-bound male has had to cling to the old conservative and generally uncomfortable standards. This difference in clothing makes it impossible to make both men and women in the same space completely comfortable simultaneously. The answer to the problem is, of course, to educate the male to wear proper clothing.

Not An Exact Science

Failure of our industry to tell people frankly that air conditioning is not an exact science has caused many of the complaints received from the public who have not been properly educated about it. Most people think of an air conditioning system as if it were a lighting system or a television set, where a flick of the switch places everything into operation at the desired rate. They do not know that air conditioning systems are designed around many variables — both fixed and changing. In addition to this are the compromises that must be made due to building construction and space limitations, to say nothing of interferences with interior decorations, furniture location and just plain cussedness.

It is necessary first to fit the best possible design around the variables and, second, the public. It should be well known that these variables render exact solutions impossible. Thermostat location is a case in point, since the whole system or zone will be controlled by the air temperature at the thermostat, even though this temperature may not be representative because of poor location. The automotive industry — with the many variables involved in automotive operation and the compromises necessary in design — has done an excellent piece of work in public education along this line. Perhaps we can steal a few pages from their book.

Three Types of Complainers

One group of complainers, quite small in number but vociferous and effective, is made up of people that will have to be educated by their fellow laymen, since our industry has no way to reach them with logic — except indirectly. This group consists of those who imagine they are uncomfortable and those who actually are so due to their own physical or mental condition. This group can be divided into three sub-groups:

1) Employees of the chronic complaining type who feel they must find something to demand to prove that they are no longer "slaves."

2) Those avid readers of pseudo-scientific literature who, having read what some "science" writer has written on the subject, proceed to prove the system is all wrong and should be corrected — with only vague and general corrections suggested, of course. These people are the ones who are comfortable in accordance with thermometer readings — regardless of the actual temperature.

3) Those who have some physical or metabolic disturbance, either temporary or permanent, that renders them so far off standard that standard conditions will not apply. Many times this body condition is unknown to the complainer.

Most individuals in this last group can be reached only by fellow employees or associates. However, indirect education through others subjected to the same conditions seems the only answer to the problem at this time.

Cost Complaints Unjustified

Many laymen complain about the cost of air conditioning, but a study of this complaint does not justify it as a major one. Purchasers always complain about prices, but they generally buy what they want if they want it enough. A survey of the number of television aerials on the "other side of the tracks" bears this out.

The principal problem faced by the layman in judging air conditioning is the result of a failure on the part of too many architects to realize that air conditioning is a part of a modern building and should be incorporated into the building design. It should be obvious that buildings of the past did not have air conditioning, or provisions for it, and present-day revivals of these designs must be revised to allow for efficient operation and installation of mechanical equipment. This requires creative architectural work, but that is what architects are for. We in the air conditioning industry should move the architect from the position of a layman to that of a patron of our art.

Layman May Be Right

Last but not least, with respect to the layman's exploration, we come to the fact that in some cases he is right, and the system does not work properly because of lackadaisical workmanship or poor design.

It seems to be the opinion of many that an engineering business should be able to solve all of the engineering problems when they arise. With the solution completed, all such future problems should thus be eliminated. The engineering branch of industry is, to a great extent, responsible for this condition — though it must be admitted that a part of the problem is due to the engineer's inability to keep up with the advertising claims of the sales branch. However, the engineer still has the responsibility to do all in his power to design properly.

Perhaps too many engineers feel that the title "engineer" is sufficient unto the end and no more study is required of them. No man is accorded this privilege, except a dead one — engineers included — and this is especially true in a relatively new engineeering industry. The lack of attendance of design engineers at technical meetings is a known scandal, and one has only to look at most designs to know that some of them must pay even less attention to progress as reported in the literature.

Far too many installations are designed on rules of thumb, or copy an earlier one. To be sure, all engineers are not in this category, but the success of those who do their engineering duty along this line only emphasizes the point. It is true that the industry does not have sufficient facts concerning the art to place in the hands of the engineer for perfect design, and we must remedy this shortcoming by more research and study.

More Research Needed

Research — or the lack of it — is one of our major problems. It is true that there is a fair amount of private research by the manufacturers in the industry which helps some, but for obvious reasons, this type of research is narrowed to a field which produces information useful to the sponsor, who is spending his money on an investment basis. General re-

search into the sciences of our art is of good quality but insufficient in quantity for several reasons. One reason has to do with the rapid growth of the industry, requiring that money that might be available for research had to be plowed back into plant expansion and other increased facilities.

Another reason is a lack of talent. In recent years there has been a serious lack of engineering graduates, as is well known. But it is not so well known that our industry has failed to obtain a fair share of this meagre supply. It has thus been necessary to use what men we did get largely on the problems of production and installation design, and as a result, research has suffered greatly for lack of men in this phase of the industry.

It is only necessary to point to the fact that at the moment our industry is not in agreement as to what conditions constitute comfort, and that the disagreement is between eminent engineers. Research could solve this. Another example that can be cited is in the panel heating field. There are many other examples that could be given, but they would be beyond the scope of this article.

The lack of sufficient research has caused a lag in the necessary fact finding to keep up with data requirements, with a result that we see many assumptions become pseudo-facts accepted by the engineers and others as facts. The only answer to this is greater research facilities. A campaign to increase the education of engineers followed by a vigilant attempt to obtain our share of graduates is also necessary. This could eliminate some of the specialization that seems to exist needlessly between the heating and cooling phases of air conditioning.

One of the engineering problems in the field of air conditioning seems to me to be that one phase — such as refrigeration, for example — has been over-stressed in some cases, and other phases — such as heating, humidification, ventilation, air distribution, air cleaning, etc. — have therefore been neglected. This is a problem which has resulted in many air conditioning installations with good cooling 25 percent of the time, but an otherwise inadequate and unsatisfactory heating and ventilating system for 75 percent of the time. Engineers — and manufacturers, too — must realize that all the requirements of air conditioning are interrelated and require adequate consideration for a successful installation. The solution to this problem is so obvious that it needs no suggestion.

Is the Job Followed Up?

One of the greatest perplexities to laymen (and non-laymen, too) is why many engineering mistakes are repeated on installation after installation. The answer is simple. Many engineers do not know a mistake was made. Too many times the design is finished when the proper initials are placed in the title box, and the prints are delivered. Failure of engineers to follow their work, not only through to completion but for a period of operation, is a black eye of the air conditioning industry. If not paid for supervision, an engineer should want to do this for his own protection, education and satisfaction.

Another problem is brought about through failure to enforce specification requirements. It is the engineer's obligation to keep abreast of equipment and application developments to the extent that he can honestly administer the "or equal" clause to give the purchaser of an air conditioning system his full money's worth with all the advantages of truly competitive conditions. He is also obligated to keep abreast of new methods of fabrication and to use them for his client's benefit in his specification and layout work.

A lack of study on the part of designers on the subject of thermal storage in the structure has contributed to many poor installations. This should be a subject of much research.

Geographic limitation is an oft neglected phase of design that can contribute to inferior operation of an installation. This applies especially to many government and large company engineering departments serving as consultants on their own projects.

Though some engineers have been lax in their duty, as pointed out, it is still the engineer that restrains contractors, equipment manufacturers and dealers from dealing completely on a first cost basis — many times the most overall expensive basis for the owner. Even when poorly administered, consulting is a benefit and good consulting is a major benefit more than justified. Perhaps one good thing that could be done for the industry would be to stage a public educational campaign explaining the function of consulting engineers in our economy.

Contractors Important Link

Contractors are an important link in the industry, since it is they who actually make the installations and who are usually financially the guarantors for proper operation of systems. In this very responsible position, however, some contractors often fail to perceive that they have an industry obligation — that of assisting in creating public confidence in the air conditioning industry.

A most important way to create such confidence is to leave every installation in proper condition for operation. This means the system should be properly tested and balanced to job conditions, the piping and equipment cleaned, and the owner's operators thoroughly educated. It is admitted that the majority of installations are properly started, but the number not properly started is high.

Many an unsatisfactory installation requires only a few changes in damper settings to make the installation a good one. Other unsatisfactory jobs result only because the operator was not instructed in the time that the installation should be started and stopped, a function of many other things beside hours of occupancy. This follow through would cost the contractor something, but it would pay big dividends in goodwill created for the industry and for the contractor too. Furthermore, it will reduce the number of unsatisfactory air conditioning systems sharply.

Contractor Creates Confidence

Another assist the contractor can render is to create a feeling of con-

fidence in the price structure of the industry by the buying public. While no restriction should ever be placed on free competition, such competition should be based on equal quality of installations and the quality should be based on the installation requirements. To do this properly requires a knowledge on the part of the contractor in qualities of equipment, methods of procedure and application requirements. He, too, has to study and keep abreast of developments. Not only the contractor himself must do this, but he must see that his key people do the same. This will not only help to prevent failure of installations due to the use of an improper material — usually because it is cheaper — but it will enable him to place himself in a more competitive position where the use of these cheaper materials is all that the application requires. A good knowledge on the part of key personnel and also the secondary personnel regarding methods of installation will eliminate many failures, since the "bugs" will be caught before installation in the field.

Since the contractor is the principal sales outlet of the industry, there is another contribution he can make that will increase greatly in magnitude as time goes on. He must hire good, responsible sales help, for they are the public contact. There is plenty of room for good hustling salesmen in our industry, but the high pressure variety who sell by substituting gimmicks for responsibility must be eliminated. In an industry with a dawning public demand as ours, this is impossible to police completely, but our sales outlets must do their best. It is recognized that some sales will be lost at first, but public confidence will more than offset this as time goes on.

The Manufacturer's Part

Manufacturers come in for their share of responsibilities in creating greater confidence. As a matter of fact, they have channels and finances with which to assist greatly.

One weakness, especially on the part of manufacturers of component parts, has been an apparent unwillingness, in some cases, to heed public and industry demands for the type of equipment which will best meet field requirements. In my experience, there has been a tendency to imply sometimes that "this is what we make — you use it or else." Such an attitude has resulted in installations that are unsatisfactory because owners had to take what was offered and their requirements were not satisfied. The accuracy of published ratings for equipment is highly important and should not be regarded lightly.

Too many of those in the air conditioning industry are prone to regard their knowledge of portions of the art as valuable secrets and hoard them accordingly. A certain amount of discovery priority is recognized as good, but when the knowledge of a method or device becomes somewhat general, then information should be exchanged since good, ultimate results in any design are beneficial to all. The changes in the diffusion of air since 1936 are a case in point.

Some fail to devote sufficient effort to study of the component parts of equipment, and yet many times the successful operation of a complex installation is dependent on the fans, motors, filters or even the less important items that make up the system.

Well, I've stuck my neck out in writing these perhaps too critical comments — maybe too far. I hope those who read my remarks will remember they are meant to be helpful, and to contribute to the sound and continued growth of the air conditioning industry — of which I am proud to be a part.

"Don't Exhaust Air Without Providing Make-Up"

"THE SAME engineer who wouldn't dream of writing a check on a nonexistent bank account will spend thousands of dollars on mechanical exhaust ventilation for a factory without providing for make-up air," said Kenneth E. Robinson, well-known authority on industrial ventilation, in a recent talk.

He gave several examples of how problems in various plants were corrected by providing make-up air. In one case, a severe problem — things were almost at the point of a walk-out — was cleared up by reducing the air exhausted by one-third and supplying make-up to replace the other two-thirds of the exhaust air.

In another case, downdraft through the gas heaters due to 10,000 cfm exhausted from a paint spray booth caused every girl in the plant to be sick during a cold spell. An air supply outlet was installed only 6 ft from the exhaust to stop the downdraft. Later, the supply was moved to the other side of the plant to provide ventilation for all.

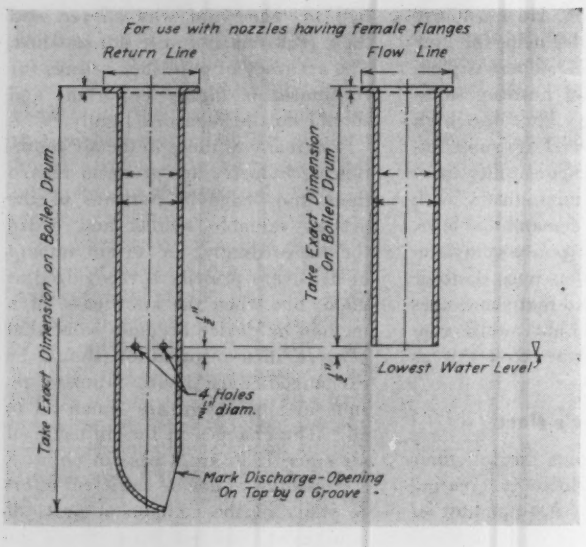
In his experience, a direct fired unit is often the most feasible means of heating make-up air, Mr. Robinson said; for example, where the required steam line extension would be extensive, where the boilers are already loaded to capacity, etc.

ASTM Expands Corrosion Test Facilities

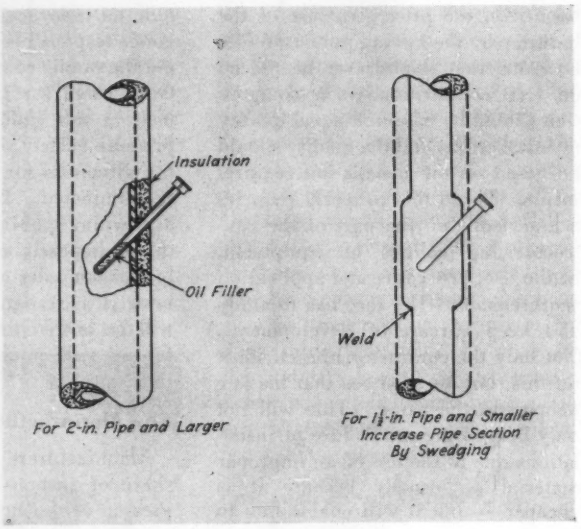
THE ASTM advisory committee on corrosion, at a meeting held recently at the site of the International Nickel Co.'s test station at Wrightsville Beach, N. C., took action to expand its test site facilities.

A billion dollars is a conservative estimate of the loss each year due to the corrosion of metals, according to the committee. The effects of atmospheric deterioration on plastics, rubber, wood and textiles would more than double this figure.

The American Society for Testing Materials long has recognized the tremendous economic significance of these problems and has been one of the foremost contributors to knowledge in these fields. Projected programs of the ASTM technical committees, as well as a number of requests from outside interests for the use of test site space, has necessitated the preparation of additional facilities at the various test site stations. Although there is at the present some unused space at all of the sites in use, it was agreed that 110 additional racks be fabricated, 60 of monel (for marine exposure) and 50 of type 302 stainless steel. These 110 racks will provide space for 7700 additional 4 by 6 in. specimens.


For use with nozzles having female flanges
Return Line
Flow Line
Take Exact Dimension on Boiler Drum
Take Exact Dimension On Boiler Drum
Lowest Water Level
4 Holes diam.
Mark Discharge-Opening On Top by a Groove

1 EXISTING BOILERS have been converted for high temperature hot water heating by installing additional nozzles and insert pipes



2 A SUGGESTED METHOD of inserting a checking thermometer into the line is shown here

High Temperature Hot Water

Designing the System and Putting It Into Operation

By S. A. Kuli
Project Engineer
American District Steam Co., Inc.

• This is the second of two articles on the subject of high temperature hot water (HTHW). The first article in the January HPAC reviewed the principles of the system and cited applications where it is being used. This month, the design of the system is discussed — including the selection of the boiler and the design of the piping. Also, the method for putting the system into operation is outlined.

THE HEATING LOAD must be calculated for high temperature hot water systems in the same manner as for any other heating system. The next step is to select the boilers. Then the maximum flow and return temperatures must be determined, which in turn give the temperature drop of the water. The average water temperature is also important for sizing the heating elements.

Selecting the Boilers

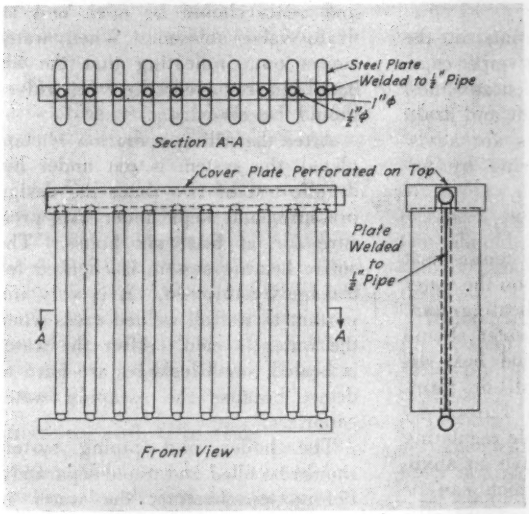
Almost any kind of steam boiler can be used for high temperature hot water heating. Existing boilers can also be converted for high temperature hot water heating by installing additional nozzles and insert pipes as shown in Fig 1. In most cases, smaller sized boilers can be used for high temperature hot water heating because of the relatively high heat content of the water.

Pressure and firing controls as well as firing equipment are the same as for the steam system. The same is true for the water level control. However, for feedwater regulators the on and off type is preferred over the modulating type. The reason for this is that feedwater make-up is very small for high temperature hot water systems. Thus, it is not necessary that the feedwater pump operate continuously. Since the boiler drum provides for water expansion in the system, a longer water level gage is often required.

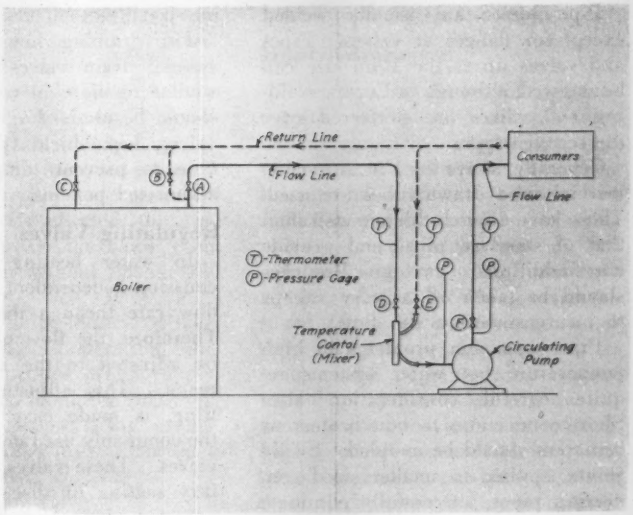
There is also little need for water treatment in high temperature hot water systems. The reason for this is because the system, with its closed circuit, uses the same water over and over again without appreciable addition. Additional feedwater is required only to compensate for losses through leaky valve packing glands and sootblower losses.

The air, which is originally present in the water, is exhausted in a short

Mr. Kuli was active in the design and installation of many high temperature hot water heating systems in Germany after the last war — while an employee of the Caliqua Heating Co. there. Mr. Kuli came to the U. S. in 1951.



3 HIGH PRESSURE radiators, such as this one, are used on many systems operating on water pressures greater than 50 psig



4 INSTRUCTIONS for putting the system into operation should be prepared by the engineer for each system. Here a schematic drawing of a system with all valves labelled is shown

time through vent valves, and there is no further contact with the air. Therefore, water treatment is usually not required. High temperature hot water heating systems of 50 to 100 million Btu per hr capacity in Europe have been operating successfully for several years without any water treatment. However, when steam is drawn from the boiler and thus more make-up water is needed, water softeners and deaerators should be used. In some of the earlier systems, where steam was taken freely from the boiler drums and no attention given to feedwater treatment, deposits and incrustations caused stoppages in the heating elements and seizures in the valve seats, as would be expected.

Feedwater pumps can be small in size because of the low demand in make-up water. Other items that are required in high temperature hot water installations are circulating and standby pumps, pressure gages on pump suction and discharge sides, flow meters in larger plants and in district heating systems, where record of flow is of importance, temperature regulators or ratio controllers, and thermometers in flow and return lines, and on the manifolds when such are installed. Thermometers need periodic checking to insure accuracy. Some engineers in Europe provide checking thermometer tubings which are welded into the water lines near the thermometers to be checked. A suggested method of inserting a checking thermometer into the line is shown in Fig. 2. The checking tubings are filled with oil which has a high boiling temperature, so high temperature readings can be made under atmospheric pressure. After removing the cap of the tubing, a control thermometer is inserted into the oil, permitting stationary thermometers to be checked.

Unit Heaters, Radiators, Panels

Almost any kind of unit heater can be used with high temperature hot water providing that it's designed for the pressure required. Unit heaters which permit even water distribution in the coils, according to the method of "reversed return" piping, are naturally preferred. In Europe, both flow and return connections are often made on top of the unit heaters for convenience. The bottom of the heating element is provided with a drain nipple.

Fin on tubes and radiant baseboard can also be used with high temperature hot water. Panels equipped with steel pipes are quite common in Europe — especially in factories.

In general, cast iron radiators may be used with pressures up to 50 psig. For higher pressures, specially designed high pressure steel radiators have been developed as shown in Fig. 3. These are fabricated from steel pipes and may consist of upper and lower headers made of 1 in. standard pipes. Between these headers, standard ½ in. pipes are welded in at 2 to 3 in. intervals. Flat steel plates which have been welded together surround the ½ in. pipes, thus enlarging the heating surface. The upper header is covered by a cap made of perforated steel plate. The temperature of the radiator surface is rather low due to the circulation of air between the pipes and the surrounding plate.

Piping Design

Piping must be designed carefully. Calculations should be based on temperature drop at the heating surface and on the pressure drop in the pipes and valves. In determining the temperature drop for the design, an economic balance is usually applied. By using a high temperature drop, smaller pipes can be used, but a higher pump head is then required, of course. In Europe a temperature drop between 110 and 150 F is generally used — which permits relatively small pipe sizes to be used.

It is usually good practice to use a reversed return piping system. This system assures that equal pressures will be available for each heating element, and adjustment is made easier.

Pipe joints are usually welded except for flanges at valves. Pipes and valves up to the 1 in. size can be screwed, although in Europe welding end valves are preferred over the screwed type.

Generally, above the 1 in. size, commercial solid drawn tubes are used. These have a much thinner wall than that of standard pipes and provide an additional saving. Branches should be taken off at easy sweeps to insure smooth water flow.

Pipe expansion problems in high temperature hot water systems require careful consideration also. Short connections to unit heaters or radiators should be avoided. Swing joints, applied to smaller sized connecting pipes, successfully eliminate stresses resulting from pipe expansion which would otherwise shear off the pipes from the main lines. One method which has been used with good results is the application of closed packless expansion joints.

Careful installation of pipe supports is important with high temperature hot water systems. The elevation of the pipes should not be permitted to be changed after installation. To insure this, roller type supports and hangers are often used. Roller hangers often consist of two hanging rods; otherwise roller brackets may turn and stick to the insulation. Pipe hangers without rollers often move with the expanding pipe which causes the pipe to be raised, especially when short pipe hangers are used, resulting in an air pocket in the line at the high point.

Venting, Draining the System

Venting is very important in high temperature hot water systems. Air in the system must be removed as completely and as quickly as possible. Air is a good insulator, and it can greatly reduce the heat transfer rate of the heating surface, especially in tubular heat exchangers when they are not vented properly. Of course, air is also objectionable from the standpoint of corrosion in the system.

Air "bottles" of large tubing may be used for venting on high points of the piping system. These "bottles", which are welded on top of the pipe with an easy sweep, are able to take in large volumes of air. The air is then discharged through a down drawn pipe and vent valve—usually of $\frac{3}{8}$ in. or $\frac{1}{4}$ in. size.

For draining low points in the system, drain valves or pipe caps, similar to those in condensate lines, should be used. For vent and drain valves, lock shield types are advisable to prevent tampering by unauthorized persons.

Regulating Valves

In water heating systems, heat emission is dependent upon the water flow rate through the heating unit. Therefore, the flow of water should be adjusted to the actual heat demand. This adjustment, or throttling, is made easy in Europe by the commonly used double regulating valves. These valves have an auxiliary seating or disc, which can be adjusted independently from the handwheel. Such valves can be closed and opened without affecting initial regulation. Prior to the development of double regulating valves, regulating problems were solved by lock shield valves installed in front of shut-off valves, or in return connection lines. The valves should have seats and discs designed for protection against wire drawing.

Filling and Testing

When the installation of a high temperature hot water system has been completed, the next step is to fill and test the system. The filling operation is performed with a hose connected to the water line. A permanently fixed connection should not be made between the water line and the high temperature hot water piping system. An incident emphasizing the importance of this point comes to mind.

One morning in a German factory an employee complained about the unusual functioning of the toilets. Instead of spill water entering the bowl when the toilet was flushed, live steam shot out. A quick investigation revealed that a fixed connection had been made between the high temperature hot water system and the plant water line. After filling the system, the operator apparently forgot to close the valve. Thus, the plant water line became an integral part of the heating system. As soon as the boiler was heated up, high temperature hot water was available in the water line. When the toilet valve was opened, the water flashed into steam.

When filling the system, all valves and vents should be open and all drain valves closed. When water comes out, indicating that the air has been removed, the vent valves should be closed.

After the filling operation is completed, the system is put under hydraulic test of two times the design pressure, and kept under this pressure for at least six hours. The entire heating system is checked for leakage by this test. It is very important to test all welded areas when the water is cold. After the water is heated, small leakages are hard to detect because the escaping water vaporizes.

The boiler and piping system should be filled and tested separately. Before test heating, the water in the boiler should be lowered to the normal water level to provide space for the steam cushion.

Test Heating

There are different methods of putting a high temperature hot water system into operation for the first time. Selecting the proper method depends upon the various design conditions. Therefore, instructions should be prepared by the engineer for each system.

An example of such instructions for starting a high temperature hot water system, which operates at a pressure of 125 psig, follows. Fig. 1 shows the schematic drawing of this system.

1) Before heating up, be certain that all valves of the boiler are closed and that the boiler is filled no higher than the normal water level. Close pump valves, but open pump cooling water valve. All shut-off valves should be wide open.

2) Raise the boiler pressure to about 60 psig.

3) Exert the pressure of the boiler on the system by opening the premixing valve, *B*.

4) Open the temperature regulating or mixing valve, *E*, wide.

5) Open the main flow valve, *A*, of the boiler slowly.

6) Open valves *D* and *F* at the circulating pump slowly.

7) Open the main return valve, *C*, of the boiler slowly.

8) As soon as pressure gages in the suction and discharge side of the pump indicate the same pressure, close valve *F* at the pump.

9) Check venting of pump and

flow of cooling water to bearing housing and to channel of stuffing box.

10) Start pump motor. (Note: Circulating pumps shall be started against the closed discharge valve, *F*).

11) When the motor is running at full speed, open valve *F* slowly.

12) Let cold water circulate in the system first, then add warm water by opening valve *D* gradually. After the water in the system has been heated up slowly, throttle mixing valve, *E*, to get the desired temperature in the flow.

Checking and Adjusting

When the water in the system has reached the desired temperature,

a) check the system for leakage and expansion,

b) check all heating units for proper operation, and

c) check the temperature in the flow and return connections and adjust the water flow rate through the units by throttling the auxiliary seat or disc of the regulating valves. This adjustment, which is of great importance, is not difficult to make when the piping system is designed with care.

Once the system has been adjusted for proper operation and regulation has been properly effected, the system should provide the same even heat distribution without further adjustment.

If it should be necessary to take the system out of operation, the following instructions which apply to the same plant should be followed.

1) Stop the boiler firing in accordance with boiler instructions, and open mixing valve, *E*, wide.

2) Close boiler valve *A*.

3) As soon as the flow temperature is down to about 210 F, close pump valve *F*.

4) Switch out pump motor, and close boiler valve *C*. (Valve *B* remains open.)

5) Do not shut off cooling water before pump is cooled down.

Many Advantages

The many advantages of high temperature hot water heating systems include simplicity, adaptability, ease of control, closed circuit, high heat storage capacity and ease of installation and operation. These advantages result in savings in first cost, fuel cost and maintenance cost.

Also, efficient production has resulted from the use of this system throughout the world in industries such as the paper, textile, rubber, plywood, furniture, cable manufacturing, wood drying, oil refining, food processing, canning, dehydration, slaughter houses and in many types of chemical processing plants.

Moreover, distribution of heat in the form of high temperature hot water among groups of buildings, as in district heating installations, universities, hospitals, apartments and industrial buildings, has proved to be effective and economical.

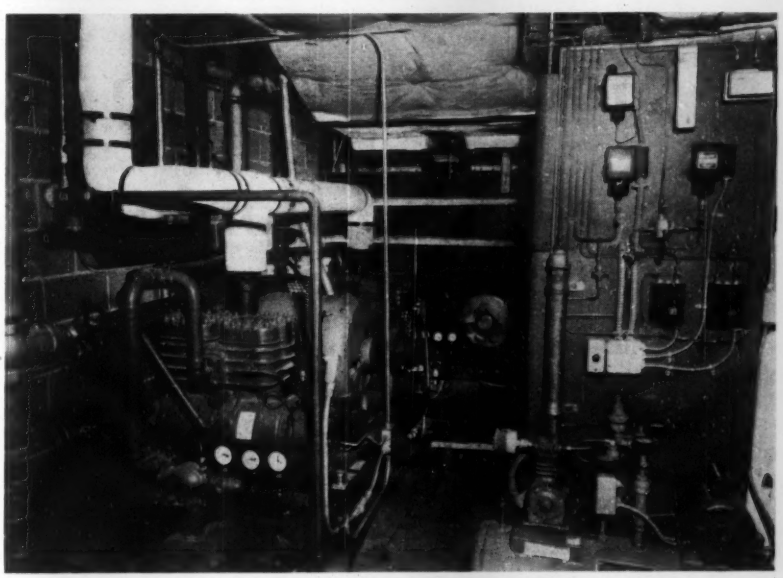
Five Systems Serve TV, Radio Facilities

THE NEW $500,000 facilities for the WSAZ radio and television stations in Huntington, W. Va., were formally opened recently.

Weather inside the station is automatically provided throughout the year by a summer air conditioning system and a central zone heating system.

The air conditioning system consists of five air handling units, each with both direct expansion cooling coil and hot water heating coil, according to Frigidaire. Air for executive offices is handled by a 7½ ton self-contained unit, general offices are kept comfortable by a 10 ton self-contained unit, and two similar units handle the two large TV studios. A 20 ton compressor connected to an eight zone fan and coil section provides air at proper temperature for announcers' booths, news rooms, transcription room, audition studios and the main lobby.

The overall grouping of equipment allows heating only, cooling only or ventilation only. Any unit can be operated independently of another and is controlled by separate thermostats. There is a cooling tower for all five systems.



SELF-CONTAINED 7½ ton unit at right cools the executive offices, 10 ton unit in rear center handles the general offices, and 20 ton compressor at left with eight zone fan and coil section provides cooling for announcers' booths, news rooms, transcription room, audition studios and the main lobby. Two other 10 ton units serve the two large TV studios

To provide a satisfactory system of ductwork throughout the building to carry the air without noise, a volume control was installed in each duct and special acoustical material was used to line them.

Modernizes with Air Conditioning

30 Packaged Units Supply 215½ Tons for Nine-Story-and-Basement AAA Offices

By Robert A. Levy
Lanier & Levy
Consulting Engineers

THIRTY PACKAGED air conditioning units totalling 215.5 tons and ranging in capacity from 5 to 10 tons each are being used to air condition the new American Automobile Association offices in Washington, D.C. The building, which is about 30 years old and is being remodelled, is nine stories high and will have an air conditioned basement — making a total of 10 floors.

The self contained packaged units are particularly adaptable to an existing building. They were selected because of their low first cost, the flexibility in zoning they provide, because they eliminate the need of cutting floors for chilled water piping, and because several of the zones will be used frequently for overtime work and will thus require air conditioning when the rest of the building does not.

325 Sq Ft per Ton

The first floor is mostly open space and very decorative in appearance. All of the stories above the first are given over to office spaces and special usage. There are three units on each of these office floors. The cooling tower is on the roof.

The air conditioning installation is designed for inside conditions of 75 F dry bulb and 50 percent relative humidity when the outside conditions are 95 F dry bulb and 78 F wet bulb. The total conditioned area of the nine stories and basement amounts to 70,350 sq ft, which does not include corridors, toilets or elevator spaces. Thus, the average floor area per ton amounts to 325 sq ft. The lighting load averages 2½ watts per sq ft. Total circulated air averages 122 cfm per 100 sq ft. This quantity includes 18.4 cfm of outdoor air per 100 sq ft. Outdoor air amounts to 15 percent of the total circulated air.

Ducts Are Insulated

The units are grouped to cool areas with similar exposures. The duct work is covered with 1 in. insulation to prevent sweating and to assure little increase in temperature of air to the conditioned spaces. A difference of 2 or 3 deg in temperature of the supply air at the registers can mean the difference between a good job and a bad one. For the office floors, the distribution ducts are run down the ceiling adjacent to the corridors and will be furred in. The returns are taken from the various office spaces through grilles in the corridor doors and the corridor serves as a return air passage to each unit. Outdoor air is admitted separately to each air conditioning unit.

This is an old building and is served with one pipe steam to each room. Inasmuch as the heating has been satisfactory in the past, it has not been touched, with the exception of the basement and first floor. The air conditioning units for these floors are equipped with non-freeze steam

coils for heating. In addition, new boilers and oil burners have been installed.

Good Distribution Essential

The main design problems involved were the selection of the number of units and their locations, the selection and location of the cooling tower, the type of controls to be used —and most important of all—the matter of distribution of conditioned air in the occupied spaces to create comfort and draft free conditions.

The ultimate end of any air conditioning design is good distribution to create comfort conditions. This involves the introduction of air to the conditioned spaces at the proper locations, at the right dew point, in the correct quantity and with good diffusion. All of the equipment has been designed with this end in view and the entire installation and distribution and controls are installed to accomplish this final aim. If this is not accomplished, an air conditioning system is not a successful one.

The ceiling height in the eight office floors is 9½ ft. Considerable thought was given to the location and number of supply registers. All registers have adjustable double deflection vanes and manual volume control to give the occupants of each room some manual control. In addition, back of each register is located an adjustable volume control combined with vanes to straighten the air flow through each register.

Controlling the System

The pump for the cooling tower has a 20 hp motor and circulates 650 gpm at 86 ft head with a 10 deg drop. The pump is wired so that it cuts in when the first air conditioning unit is turned on. The pump is controlled so that it stops operation when the last air conditioning unit is cut off.

Control of the cooling in the various zones is accomplished with the use of the built-in thermostat of each unit which is in the return air stream. The matter of using time clocks was studied rather thoroughly. It was found impossible to operate all machines from one time clock to cut on and off all machines at the same time due to the usage factors in the various spaces. Some of the spaces will be used after regular working hours and throughout the night as well as day; others, in the daytime only.

The alternative would have been to use one time clock for each unit but this was deemed not a satisfactory arrangement due to the varying occupancy factor, and because of the need for maintenance and regulation. The building operator will turn on all units the first thing in the morning and one person in each zone will be delegated to turn off his machine at night when that particular department quits work. During operating hours, the fans for all units will be kept running continuously.

This type of air conditioning design is always an interesting one. As more and more old buildings are air conditioned in the future, this type of installation will find increasing applications.

The total cost of the air conditioning contract amounts to approximately $86,000, or about $400 per ton.

The architect for the remodelling of the building is A. R. Clas, with George H. Riggs, Jr., associate. The general contractor is Wm. P. Lipscomb Co., and the mechanical contractor is Morris and Eagan Co. We were fortunate to have a fine architect on this job and first class contractors to do the installation work. Lanier & Levy are the consulting engineers.

Air Conditioning Motor Start Aided by Capacitor

HEAVY STARTING CURRENT drawn by a 400 hp motor in the air conditioning system caused a 22 percent voltage drop. A capacitor bank cut the drop to 13 percent, made a more expensive rewiring job unnecessary

A CAPACITOR installation solved a motor starting problem when a 400 hp, 220 volt synchronous motor was substituted for two 200 hp motors in the air conditioning system of Kaufmann's department store, Pittsburgh, says the Westinghouse Electric Corp.

Heavy starting current drawn by the larger motor caused a 22 percent voltage drop and prevented the motor from locking into synchronism. The problem was solved with a 135 kvar, three phase, 230 volt capacitor bank installed near the motor. The starting voltage drop was reduced to 13 percent, and a more expensive and time consuming rewiring job was obviated.

Motel Guests Want Good Heating

MOTEL GUESTS appreciate the comfort of panel heat, according to a recent article by C. F. Craigie, Jr., of the Plumbing and Heating Industries Bureau, in American Motel magazine.

The article describes the heating system of Mickey's motel on U. S. 41, just south of Milwaukee.

"After all," as Michael Tuska, the proprietor, puts it, "what have we got to sell if not comfort, which begins with a good heating system?

"The first thing that enters the head of a motorist when he sees the motel is: 'Will the rooms be warm?'

"We believe in telling him so — right on our sign. For if there is one thing we have learned, it is this: Good heating means good business."

The motel has 10 rooms. The heating system consists of two separate floor panels, each taking care of the needs of five rooms. A centrally-located thermostat controls the heating of each panel.

An oil fired boiler circulates hot water to the two panels in accordance with demands of the two thermostats for heat. Coils submerged in the heating boiler indirectly heat water for domestic purposes.

What NOT To Do:

These Heating and Piping Installations Needed Correcting

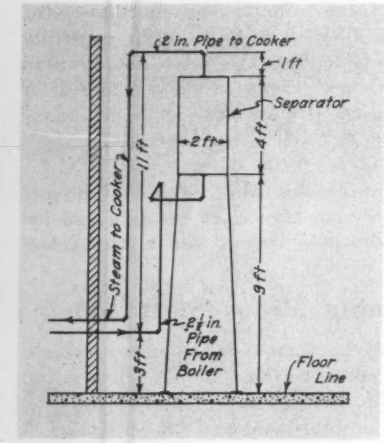
By C. T. Baker
Consulting Engineer

Case Histories from a Consulting Engineer's files

CASE NO. 1 —

Condensate Couldn't Drain

Trouble was experienced in a packing plant from excessive water hammer in the long steam supply line to the lard cooker. Accumulations of condensate in the cooker and in a separator on the steam line were also giving trouble. The condition was most pronounced following overnight and weekend shutdowns, during which time the valve on the steam supply—located near the main steam header in the boiler room—was closed. Each morning, sufficient time was required to free the pipe and cooker of condensate and to slowly warm the steam supply line so as to prevent damage from water hammer.



1 NO PROVISION had been made for draining the separator

The steam line hookup is shown in Fig. 1, and from this it can be seen why operating troubles were experienced. No provision had been made for draining the 2 ft x 4 ft separator. As condensation occurred and collected in the drum, it could escape only by draining back to the main steam header leading from the boiler room and by flowing along with the steam being supplied to the lard cooker. No part of the steam supply line or the condensate drum was insulated.

This monstrosity is being removed, and the steam line is being run direct to the cooker in order to keep the line free. In addition, the piping is being well insulated. Obviously, the original hookup, which has been in use for several years, resulted in a considerable waste of fuel.

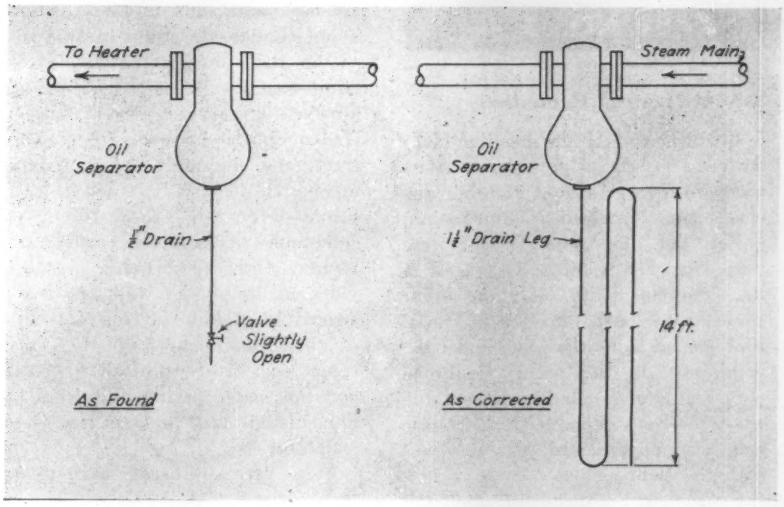
CASE NO. 2 —

Oil in the Wrong Place

An industrial plant generated about 35 percent of its power requirements and purchased the remainder from the utility company. Boiler feedwater was preheated in a deaerating feedwater heater arranged to use exhaust steam from the engine generator set and a duplex boiler feed pump. An automatic live steam makeup valve supplied any deficiency in heat during the periods when the engine was off the line. Soon after the feedwater heater was placed in service, oil was noticed in the gage glass of the water tube boiler. Without any effort to determine the source of the trouble, the operator merely decided that it would be impossible to use the exhaust from the engine and the feed pump, and it would have to be released directly to the atmosphere. This, of course, removed the oil problem, but it put a burden on the boiler to supply enough live steam to the heater to maintain the necessary high temperature to insure deaeration of the feedwater.

Some years later, a survey of this plant was made to determine if im-

Mr. Baker, consulting engineer specializing in heating, piping, air conditioning, refrigeration and power, draws upon cases from his wide experience to cite examples of "what not to do" in the design and installation of heating and piping systems.



2 THE OIL SEPARATOR had been installed in the exhaust steam main

provements in the operating procedure were possible. One of the first things corrected during the course of the investigation was stopping the waste of exhaust steam.

A very interesting situation was uncovered. The oil separator had been installed in the exhaust steam main as shown in Fig. 2. It is apparent that it would be physically impossible to properly drain the separator with such an arrangement. The drain line shown was made of ½ in. pipe, with the valve as indicated. In order to prevent blowing through — at the pressure maintained on the feedwater heater — this valve was kept practically closed, and consequently, drainage was defeated.

The problem was corrected by increasing the drain pipe from ½ in. to 1½ in. making it into a loop of sufficient length to prevent blowby from the heater. The corrected piping hookup is also shown in Fig. 2. A 1½ in. x ½ in. bushing was removed from the bottom of the separator to accommodate the connection of a 1½ in. pipe.

This correction eliminated the trouble. While the steam engine is in operation, ample exhaust steam is now available for feedwater heating. At other times, the deficiency is made up by live steam, as the duplex pump — of itself — does not supply the necessary heat for maintaining the water at the temperature required for deaeration. No oil has passed over to the heater since the change in the drain connection was made.

CASE NO. 3 —

Preheating Coil Ruptured

In a steam plant with two boilers — one rated at 150 hp and the other at 200 hp — the fuel oil was delivered to each of the steam atomizing burners at 40 to 45 psig by a duplex pump. Duplicate pumps were each supported on a common cast iron base, and a shell and coil oil heater was between them. Exhaust steam from whichever pump was in operation supplied the necessary heating effect to preheat the fuel oil before it was delivered to the burners. A back pressure valve was connected to the exhaust outlet so as to maintain a slight back pressure, thereby raising the temperature of the exhaust to the point where satisfactory preheating of the oil was possible.

This system worked satisfactorily for several years until one morning when the day crew was taking over, the fireman noticed a badly bulged shell over the furnace of the large boiler. After the boiler was removed from service and cooled sufficiently to permit an examination, it was found that the bulging of the shell resulted from overheating, caused by deposits of fuel oil. Investigation of the fuel oil pump and heating assembly disclosed that the heating coil around which the oil was pumped had ruptured for some distance along the seam. As the pressure of the oil was greatly in excess of the exhaust steam pressure, the oil was naturally carried to the open type feedwater heater and then on to the boiler.

To prevent any similar occurrences in the future, exhaust steam from the pumps was released to the atmosphere instead of being used in the feedwater heater. Actually, the amount of heat recovered from the exhaust of these fuel oil pumps was not worth taking the chance on damaging the boiler.

CASE NO. 4 —

Small Changes Conserve Heat

An orphans home, which was founded and operated by a religious organization, complained about the cost of operation of their boiler plant which supplied steam and hot water for the institution which included several buildings — mostly of masonry construction.

An investigation of the boiler plant and steam distribution system disclosed several sources of waste — one of the most glaring of which was the losses resulting from the infiltration of outdoor air through the brick settings into the furnace and combustion chamber of the two 125 hp hand fired boilers. Another source of waste was the lack of draft control.

These matters were corrected by closing the openings in the brick settings and by providing a hand damper in the smoke pipe of each boiler. These improvements resulted in a decided saving in coal. However, there were still other sources of loss that needed tracking down and correcting.

Hot water was supplied from a hot water heating and storage tank — 36 in. in diameter x 10 ft long — fitted with a live steam heating coil. A reducing valve on the steam supply line near the heater reduced the coil working pressure to 25 psig from a boiler pressure of 100 psig.

A large steam trap, placed below the heater, drained the coil of condensate and then discharged it to a tank from where it drained to the sewer. Steam was kept on the heating coil 24 hr per day but without benefit of thermostatic control.

As is frequently the case with charitable organizations, this installation was limited in the matter of expenditures for plant improvements.

However, after a survey of conditions which showed that a very substantial reduction in fuel costs could be realized for a cost not exceeding $400, the improvements were authorized.

A 1½ in. thermostatic water temperature regulating valve with strainer — costing $150 installed — was the first investment made. A substantial reduction in steam consumption followed this change.

A steel tank about 4 ft in diameter x 8 ft in length was discovered in the basement of one of the buildings. As it was in good condition, it was set up in the boiler room as a condensate collecting tank for the several steam traps in use — including the trap draining the steam coil of the water heating tank. The tank was elevated about 10 ft above the steam driven duplex boiler feed pump, and a liberal size suction line to the pump was provided. This enabled the pump to handle the hot condensate without becoming vapor bound. This work, including the installation of a make up water float valve to the tank, did not add any appreciable expense to the improvement program.

Two large steam radiators, one in the dining room and one in a dormitory, were without traps. Consequently, all steam condensed in these radiators was wasted, in addition to the live steam that often blew through the radiators at a pressure of 20 to 25 psig.

A steam heating coil in the basement of one building which consisted of 125 lineal feet of 1¼ in. pipe was operated without a trap. Consequently, steam blew through continuously during the heating season at a pressure of 100 psig. Three steam traps costing a total of $110 as installed — removed this source of heat waste. The condensate from these traps was returned to the tank in the boiler room for use as boiler feedwater.

The balance of the fund made available for improvements was spent for pipe insulation and for insulation for the water heating tank. The following heating season showed a reduction in fuel consumption considerably in excess of the cost of the improvements. A small plant oftentimes may be made to produce steam very economically if attention is given to such matters as heat conservation by the use of inexpensive equipment.

CASE NO. 5 —

School Heating Remedied

Investigation of the heating plant that was failing to perform satisfactorily in a large school building disclosed some interesting information.

Four of the class rooms were heated by hot water coils placed in the concrete floors, and the other rooms were heated by steam radiators located along the walls under the windows. In the rooms equipped with radiators, conditions on the whole were acceptable but trouble had been experienced in the rooms with the floor panels. To overcome the problem, suspended type unit heaters had been installed near the ceiling in these rooms. The units were supplied with steam at a pressure of 3 to 5 psig, and so long as the boiler pressure was sufficient, these units — which were thermostatically controlled — did a satisfactory job of supplementary heating.

An examination of the boiler controls showed that due to an improper adjustment, the gas fired boiler supplied only ½ to 1 psig to the heating mains of the entire building. This, of course, was totally inadequate to meet the requirements. The proper adjustment was made and the minimum pressure was set at 5 psig. After this, any trouble experienced with heating the class rooms could be charged to low pressure in the boiler.

Water for the radiant floor coils is heated by a shell and coil exchanger, or "hot water generator" which, at an entering steam pressure of 5 psig and a water temperature from 130 to 150 F, is rated at 348,000 Btu per hr. As no thermometer had been provided to indicate the temperature of the water leaving the heater, it was impossible to adjust the modulating steam control valve. No one knew what temperature the water was being supplied to the floor panels, and furthermore, no thermometer had been provided to indicate the temperature of the return water from the coils. Absence of a pressure gage made it impossible to determine the pressure at the pump discharge outlet. Meanwhile, the motor driving the water circulator was running dangerously hot. In fact, it burned out during the investigation.

This motor and another, driving a hot condensate pump located in a pit in the room which housed the equipment, were operated without any ventilation whatsoever. The entrance door remained closed at all times and the ambient temperature in the 10 ft x 7 ft x 10 ft, 8 in. room never fell below 100 F — sometimes it climbed considerably higher. Only one window was provided in the outside wall, and it was strictly for light. The source of most of the heat released in this small room was from uninsulated steam and hot water piping and from the uninsulated shell of the hot water generator.

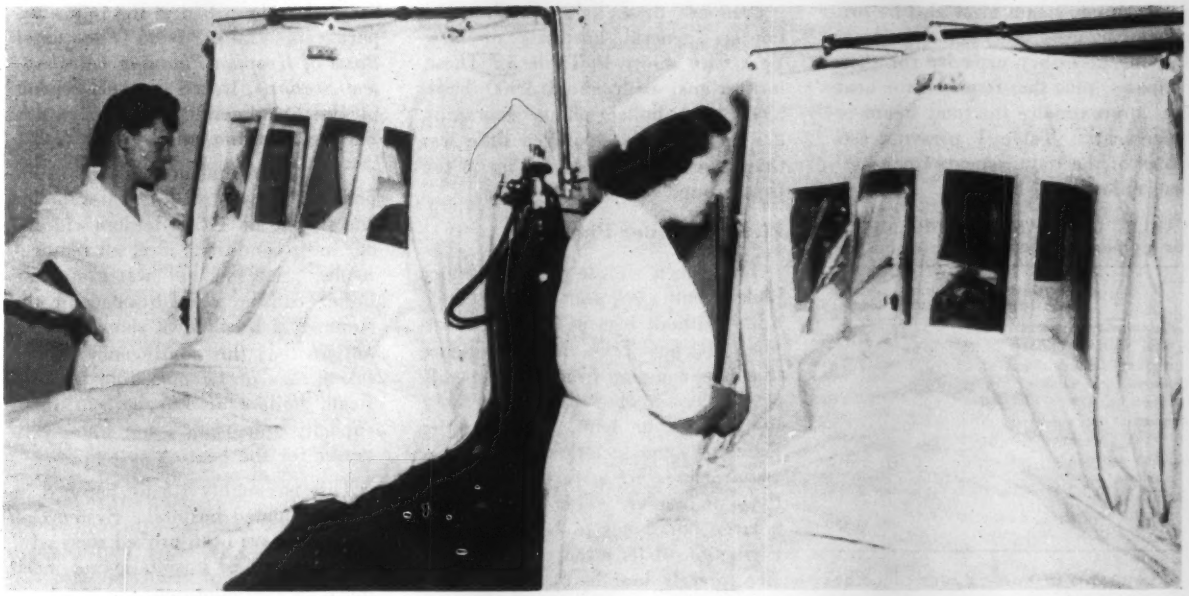
Steps are now being taken to improve these conditions. Adequate ventilation will be provided, and the exposed piping and water heater will be insulated. Also, the necessary thermometers and pressure gages will be installed to permit accurate observations of the performance to be made.

Air vents in the hot water system were conspicuous by their absence. The burned out motor was rewired and put back into operation. After supplying a temporary vent, several hours were required to extract sufficient air from the system to establish circulation.

This installation was made several years ago, and no records were available to indicate what had been installed. Also, no drawings were available to show the general layout and arrangement of the piping beneath the class room floors. Furthermore, no one is now connected with the institution that has any knowledge of the plant layout, nor how it is supposed to operate. However, the owners are quite critical in their views of those responsible for its design and installation.

ASTM Approves New Insulation Specs

RECENT IMPORTANT actions of the administrative committee on standards of the American Society for Testing Materials, 1916 Race St., Philadelphia 3, include the approval of new tentative specifications for 85 percent magnesia thermal block insulation (C 319-53 T) and 85 percent magnesia thermal pipe insulation (C 320-53 T).



BY REDUCING boiler plant sizes for hospitals greater flexibility may be achieved without loss of effective heating, according to Mr. Neergaard

Cut Hospital Heating Costs

. . . by carefully sizing the heating plant, says Charles F. Neergaard, of Neergaard, Agnew, Craig and Westermann, Hospital Consultants

SEVERAL WAYS TO SAVE

Important economies in hospital costs can be achieved without reducing the efficiency or reliability of the mechanical installations, says Mr. Neergaard. One of them — discussed this month — is the careful sizing of the heating plant. Use of thermal insulation and double glazing was covered in his article in the November HPAC. Ventilation and air conditioning of hospitals will be outlined in future articles by Mr. Neergaard, a well-known hospital consultant with many years of practical experience.

THE PROBLEM OF decreasing mechanical plant costs in hospitals is not completely solved by the full utilization of insulation and double glazed windows. There are other factors that are also important and can be considered by the heating, ventilating and air conditioning engineer in further reducing hospital costs.

Boilers Sized Differently

For the past 20 years, a 200 bed, fully insulated hospital in northern Canada has been satisfactorily heated with a 60 hp boiler. In comparison with this, there is a small 50 bed New York hospital which is only partly insulated that has a 150 hp boiler. Also, a 150 bed partly insulated hospital in Virginia (design temperature 10 F) has a 200 hp boiler. Each of the three hospitals has a standby boiler. Regardless of the variations in thoroughness of the weatherproofing, these differences are considerable. If the extent of insulation were equal in each of these installations, the differences would have been even greater, of course.

One Hp Per Bed

The two hospitals in New York and Virginia seem grossly oversupplied with boiler capacity. C. E. Daniel, formerly consulting engineer for the U. S. Public Health Service, who has designed a large number of economical and efficient hospital mechanical plants, has found that for uninsulated hospitals, boiler capacity for heating can be roughly approximated at 1 hp per bed at an outdoor design temperature of zero and 1 sq ft of radiation for each 80 cu ft of finished space. For fully insulated buildings, boiler capacity for heating need be only ½ hp per bed and 1 sq ft of radiation for each 160 cu ft of finished space. These are only approximate, must be used with care.

Of course, steam must also be provided for uses other than heating; and the necessary capacity for these purposes, plus that required for heating, approximates the total steam requirements. Table 1 presents estimates of the requirements for a 100-bed, uninsulated hospital.

TABLE 1—STEAM REQUIREMENTS for a typical 100-bed uninsulated hospital

Use	Maximum Boiler hp	Steam pressure	Hrs. per day at varying loads
General heating system	68	2	24
Special heating, operating and delivery rooms	2	2	6
Domestic hot water supply	10	2	16
Laundry: hot water	15	2	7
steam	11	100	7
Kitchen and dishwashing	6	2-20	6
Sterilizing	10	40	5
Total	122		

As shown in Table 2, our office has records of 13 institutions with over 2800 beds in the central and northeastern part of the U. S. and in Canada that have operating boiler capacities of no more than 1 hp per bed. None of them has ever had any trouble with insufficient heat. The total boiler capacity, including the standby, averages 1.4 hp per bed in these hospitals.

Compare these figures with those for six general hospitals in New York City shown in Table 3. These institutions, with about 2900 beds, have total boiler plants averaging 2.6 hp per bed — only a little less than twice the total of 1.4 hp in the first group.

Flexible Boiler Plant

There is a simple way to reduce boiler plant sizes and improve flexibility without loss of effective heating. It has been my experience that it is common practice to specify two boilers, each sufficient to carry the total winter load. This practice disregards the fact that the summer requirements are a third or less than those in winter. The result is that a large boiler has to be operated at a fraction of its rated capacity from five to eight months of the year, depending on hospital location. Since modern boilers may run most efficiently at from 120 to 150 percent *above* rating, any plant with two boilers, each of which is sufficient for the total winter load, is probably wasteful.

A practical flexible boiler installation will eliminate this waste. A suitable installation for a 100-bed hospital is described in the following paragraph, taken from *Functional Basis of Hospital Planning* (*Mechanical Section*), issued by the Division of Hospital Facilities, Public Health Service, Washington, D. C.:

"For a hospital of this size (100-bed) a 70 hp steel hot water boiler and two 40 hp 125 lb boilers will under most conditions meet all requirements. As the hot water heating boiler can be reconditioned in the summer, a breakdown should not be anticipated; this contingency can be taken care of by operating the two steam boilers at 125 percent rated capacity and using a hot water converter for the heating system."

This is roughly 1.5 hp per bed in an uninsulated hospital. Systems of this type have been proved successful in a number of hospitals, and merit more general adoption.

Hot Water System Simple

We have found the circulating hot water type of system to give highly satisfactory service for hospitals. It is easy to regulate, sensitive to temperature control and efficient as well as comfortable. A closed system, properly zoned, with thermostatic control in the boiler room, is simple and quite suitable for the hospital.

When selecting the radiation for hospitals is under consideration, the same wide variations in engineering design are found as in boiler plant design. In this connection, I often like to point to the differences in radiation capacity found in identical private patients' rooms in two northern U. S. hospitals. Both rooms have the same measurements, the same wall construction, and the same make and size of windows. Both are heated by circulating hot water, and both have the same heating requirements since they are in the same latitude and experience about the same degree-day heating demand per season.

One of these hospitals is in a sheltered valley. The typical room has 62 sq ft of radiation and 1¼ in. connections. Only a few miles away the other hospital, located on a highly exposed spot, has 48 sq ft of radiation in the typical room with ¾ in. connections. Mr. Daniel, who designed and installed the latter system, naturally kept his eye on it, and told me that the rooms have been

TABLE 2—HOSPITAL HEATING plants which are performing satisfactorily with capacities of 1 boiler hp or less per bed

Location	Date erected*	Bldgs.	No. of beds	No. of boilers	Boiler hp Winter	Boiler hp Standby	Approx. space insulated
New York	1918	3	100	2	100	100	0
Maryland	1936	5	158	2	130	130	1/3
Pennsylvania	1945	11	295	3	300	150	¼
Connecticut	1940	2	70	2	60	60	0
Maine	1940	8	213	3	136	2 at 60	¼
New York	1939	1	135	3	109	2 at 63	0
Connecticut	1941	8	385	3	300	150	½
New York	1945	4	145	3	150	2 at 100	0
New York	1936	2	162	3	150	150 & 60	½
Canada	1937	2	200	2	60	60	All
Ontario, Canada	1932	4	547	2	250	250	½
New York	1939	4	196	3	160	2 at 106	½
New York	1929	6	195	2	125	125	None
Total beds			2801	Total boiler hp			3923
				Average hp per bed			1.4

*Date erected is for most recent building when usually a new, large boiler was installed to carry the winter load.

TABLE 3—HOSPITAL HEATING plant capacities in six hospitals in the New York metropolitan area

Hospital	No. of bldgs	No. of beds	No. of boilers	Total boiler hp	Hp per bed
No. 1	7	340	6 at 160	960	2.8
No. 2	6	410	3 at 300	900	2.2
No. 3	9	520	1 at 500		
			2 at 200		
			2 at 286	1472	2.8
No. 4	7	650	2 at 800	1600	2.5
No. 5	10	800	1 at 400		
			1 at 531		
			1 at 373		
			1 at 504		
			1 at 346	2154	2.8
No. 6	5	192	2 at 250	500	2.6
Total		2912		7586	2.6 (av.)

kept perfectly comfortable ever since construction was completed 24 years ago.

A bit further south, the insulated hospital which was described in my article in the November HPAC has only 28 sq ft of radiation in rooms of the same size and with the same windows as those in the other two, with connections made of 5/8 in. copper tubing. The plant and the radiators have operated with perfect satisfaction for the past 16 years.

Table 4 gives additional examples of variations in radiation areas in hospitals that are wholly insulated and others that are either partly or not at all insulated.

There is no question in my mind that many hospitals are from 50 to 100 percent oversupplied with boiler capacity and radiation. This is the unavoidable conclusion to which our firm has come after over a generation of experience in this field.

TABLE 4—COMPARISON of the amount of installed radiation with the volume of various hospitals with and without insulated walls and double-glazed windows

Location	Cu ft of building	Sq ft of radiation	No. of cu ft for each sq ft of radiation	Insulation in walls	Double glazing
		Hospitals Completely Insulated			
Canada	550000	5100	107	Yes	Yes
Pennsylvania	750000	3750	200	Yes	Yes
Maryland	560000	3590	156	Yes	Yes
Connecticut	1605000	13248	121	Yes	Yes
Canada	1880000	16600	113	Yes	Yes
		Hospitals Partly Insulated			
Pennsylvania	333000	3343	99	Yes	No
New York	514000	7320	70	Yes	No
New Jersey	425000	6600	65	No	No
New York	605000	7400	85	Yes	No
Virginia	1137521	23813	47	Yes	No

It is sometimes roughly estimated that heating plant installations run around $6.50 per sq ft of radiation, including boilers and equipment.

In the first group all except the first hospital listed are wings added to existing structures.

Panel Heating In Hospitals

We recently recommended panel heating for a small Rhode Island hospital. Alternate plans and specifications were prepared for other types of installations. A heating contractor, who was experienced with, and strongly in favor of panel heating bid 10 percent less on the panel system, and installed it with a resultant sizable dollar saving for the institution.

Although the embedded panels, considered alone, may seem costly, it must be remembered that they eliminate other costs, and in this type of plant largely do away with hung ceilings and the need for plaster. Thus both weight and space are saved, permitting lower buildings with the same floor-to-ceiling heights. In addition, of course, ceiling panels permit free use of the walls, even under the windows. It is true that panel heating systems—as do other types—perform most satisfactorily in hospitals that are well insulated and have double glazing. The resulting low heat loss can be offset easier of course by the low temperature panels. The use of double glazing is particularly important, since it helps to eliminate the problem of cold drafts at the windows.

Installation costs are undoubtedly a real factor in panel heating although so few buildings with such construction have been built that reliable cost data is not yet available. The embedded coil in the slab should involve no additional expense, but when the coils are in a hung ceiling the cost will be somewhat higher but not over 15 to 25 percent, if they are properly designed.

I quote from a letter received from the director of the Civic Hospital, Basle, Switzerland:

"The new pavilion of the Basle Civic Hospital cost 22,000,000 Swiss francs ($5,060,000) and the increase in cost due to the installation of ceiling heating was 100,000 Swiss francs ($23,000)."

Many engineers bring up the problems of maintenance and the danger of possible leaks in connection with panel heating. There is convincing evidence that these are not serious and need not be considered in an evaluation of this type of heating.

Back in 1937 the London central bureau of hospital information published a report on the experience gained in British hospitals with panel heating. It covered 42 hospitals which had systems in use from 15 to 20 years—or for a total of 232 heating seasons. No leaks had developed; no repairs to the embedded panels had become necessary. Less cleaning and redecoration was required in these institutions than in others. Warmth was always evenly distributed and comfortable temperatures maintained with the use of central controls only; individual room controls were practically never touched.

Mention can also be made of some more recent Swiss reports. In 1947 there was published a review of operating experience with 170 panel heated buildings over a 10 year period, from 1937 to 1947. Hospitals numbered 34; office buildings, schools and so on totalled 85 and there were 51 residences. The review reported high operating efficiency and economy, and no tube leaks.

[The author wishes to acknowledge and thank Groff Conklin for his help in preparing this article.]

Applied Research, Management Make Us More Productive

THE AVERAGE American worker in 1950 was nearly three times as productive as his western European counterpart, according to studies announced by Stanford Research Institute. He also was able to buy about three times as much with his earnings.

After several years of staff research and travel in 11 countries for the U.S. Army's operations research office, the institute has made a general report of some of its findings.

The studies indicate that the prevalence of applied research in American industry may explain part of the U.S. production advantage.

The researchers say the type of industrial management also makes a great difference. European management traditionally has a financial background rather than typical American marketing or production viewpoint.

Must Push Commercial Atomic Power

ALTHOUGH ATOMIC power will take years to become a "major competitor" in the generation field, the nation has no choice but to push its commercial development, according to A. C. Monteith, vice president in charge of engineering, Westinghouse Electric Corp., in analyzing the world's energy resources.

They Like "Conference" Sessions

Attendance and interest in the air conditioner conference and the water conservation symposium at ASRE meeting indicate wide interest in "conference type" sessions

By Harold J. Prebensen
President, Air Comfort Corp.

• Mr. Prebensen, who attended the ASRE's recent annual meeting, reports here for HPAC on two of the sessions which particularly interested him

THE EFFECTIVENESS and popularity of "conference type" technical sessions was apparent from the large attendance at the air conditioner conference held during the 49th annual meeting of the American Society of Refrigerating Engineers, at the Shoreham hotel in Washington, D. C. The conference was under the able leadership of Justin Neuhoff, of the General Electric Co.

Air Cooled Units

Among the papers was a most interesting one on the performance and operational costs of air cooled packaged cooling units, which was presented by J. D. Loveley, of the Chrysler Corp. He said that "waterless" condensers give these important advantages: (1) No water usage whatever. (2) Reduced maintenance. (3) No seasonal drainage of water circuit. (4) Low operating cost. (5) Low floor area. (6) Installation flexibility. (7) Quietness.

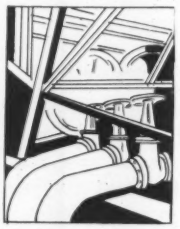
Room Humidity Control

W. O. Kline, of the Frick Co., discussed closer control of room humidity with unit conditioners. He said that straight dry bulb control of unit conditioners can become ineffective when it is needed most and that wide variations in humidity occur with "on" and "off" dry bulb control. He said that the effective use of the bypass gave humidities of 42 to 50 percent, and he recommended the use of two units, each of one-half the required capacity, as a means of getting closer humidity control. On multiple installations of unit air conditioners, it becomes possible to use a reheat coil on only one unit — where conditions can be met thereby — at a lower first cost.

Herbert Wolf, of the Worthington Corp., spoke on the protection of integral horsepower, refrigerant cooled, hermetic motors as applied to packaged self-contained air conditioning units. He pointed out that the basic criterion of motor protection was winding temperature — and that as the winding temperature increases, the life of the insulation on the windings decreases. As an example, he stated that an 8 to 12 deg increase in winding temperature can actually halve the life of the insulation. Both low and high voltage are also detrimental. Gas cooled windings are affected also by evaporator temperature, low loads, etc., and he recommended the use of manual re-set on the high pressure cut-out for internally protected hermetic motors. Motor losses per pound of refrigerant handled by the compressor increase at low evaporator temperature and hence winding temperatures increase. This fact is inherent in refrigeration systems and presents the problem of adequate protection for gas cooled hermetic compressor motors.

Absorption Equipment

W. M. Simpson, of Servel, Inc., sketched the development of absorption equipment for air conditioning. Although the coefficient of performance of the compression cycle is four to five times that of the absorption cycle, Mr. Simpson stated that the comparison is not properly made because each cycle is on a different basis. He said that the compression



cycle uses a higher form of energy — electric power — whereas the absorption system uses direct heat, such as gas. The inference was that the performance coefficient of the compression cycle should be "backed up" through the power plant producing energy direct from fuel, after which the comparison should be made with the absorption cycle coefficient. In any event, it was pointed out that the actual cost per ton of refrigeration for power and water for either system should be carefully considered.

Year 'Round Marketing

Several recommendations were made by J. R. Hertzler, of the York Corp., for marketing packaged air conditioners the year 'round. The first four are addressed to manufacturers, and the others to distributors and dealers:

1) Inaugurate sales campaign on a 12 month basis.

2) Conduct sales training on a 12 month basis.

3) Minimize model changes.

4) Undertake inventory financing.

5) Offer concessions at the consumer level in cost of units installed in the off-season.

6) Offer price protection for off-season purchases.

7) Use deferred payments.
8) Promote architectural contacts.
9) Stimulate builders' sales.
10) Establish new dealer accounts which have low seasonal activity in spring.
11) Promote residential sales, tying in cooling with heating.
12) Emphasize the year 'round system rather than cooling only.

Selling packaged air conditioning at a profit was the timely subject of D. V. Petrone, president of the Typhoon Air Conditioning Co., Inc. His formula for a profitable operation comprises salesmanship, air conditioning know-how, good service, and financial stability.

Mr. Petrone was emphatic that the characteristics and capabilities of the salesman selling packaged air conditioners include the following:

1) A good salesman is a hard worker, enthusiastic, who sells himself first and his product next. He builds up the interest of the prospect in him.

2) The salesman should know his product thoroughly.

3) The good salesman should know his prospect, his prospect's business, etc.

4) A good salesman will build up the benefits of air conditioning to the prospect. The timely comparison made by Mr. Petrone was that the air conditioning sale is not selling the drill but rather the hole that the drill makes.

5) The good salesman is tactful. He does not antagonize his prospect. He leads the prospect and does not drive him. He knows how to close a sale, and when that sale is closed not to stay any longer.

A good salesman gets the customer to help or assist in selecting one of several equipment locations, all of which will give a satisfactory job.

Finally, Mr. Petrone re-emphasized that good service helps to sell additional jobs.

Water Conservation Problems

Edward Simons, past president of the ASRE and a consulting engineer, was moderator of the water conservation symposium. Attendance at this symposium as compared to the general technical sessions was evidence of the high interest in the subject.

Raymond C. Kelly, executive manager of the Cooling Tower Institute, traced with pictures the growth and development of the cooling tower as a means of water conservation.

Paralleling the progress of industry over the past 50 years, cooling tower designs have been developed to meet ever greater demands for colder water at less cost, Mr. Kelly concluded. The quest for new and better methods continues. Studies in the use of laminated redwood, plastics and impregnated woods are in process. Thermostatically adjustable, variable pitch propeller type fans are ready for production. Densely packed towers of the film surface type are on the market. It would appear certain that from the comprehensive research programs now being carried on by the tower manufacturers will come the design refinements and production techniques necessary to keep the industrial cooling tower in constant demand as the primary device for the conservation of water and as the basic industrial unit for effcient water utilization, he said.

Factory assembled, smaller cooling towers were discussed by E. B. Dunphy, of Acme Industries, Inc. He pointed out that recent years have brought the greatest developments in this field, occasioned by the fact that water shortages and municipal ordinances have forced the issue. All small towers have attempted to reduce space and noise, he said. The residential market, which has expanded greatly in the last year, has made serious demands as regards the size of a cooling tower and the quietness of its operation.

Evaporative Condensers

Harland Rex, of the Carrier Corp., indicated that evaporative condensers came into use about 1932. As evidence of the growth in the application of the evaporative condenser, Mr. Rex stated that industry sales in 1936 amounted to about $500,000, and in 1950 the figure was approximately $9 million. In comparing the initial costs of an evaporative condenser to a water cooled condenser with a cooling tower, a saving of approximately $10 per ton of capacity results, he said. He also pointed out that the pumping cost for an evaporative condenser was considerably less than for a cooling tower, since the water head is less and the water quantity is approximately one-third of that handled in a cooling tower. Maintenance, however, may be higher on an evaporative condenser than for a cooling tower, he indicated.

Air Cooled Condensers

The paper on air cooled condensers presented by O. J. Nussbaum, of the Kramer-Trenton Co., received probably the greatest attention at this symposium. He said that, until recently, air cooled condensers have been used mostly in small refrigeration applications, domestic refrigerators and fractional horsepower condensing units. He pointed out that the air cooled condenser is free of several problems encountered with wetted surface condensers. He further pointed out that remote air cooled condensers, which are now relatively common in residential and small commercial air conditioning applications, have these important advantages:

1) No freeze-up of water circuit.
2) No plumbing cost.
3) No maintenance.
4) No drainage problem.
5) A relatively simple method of control of head pressure.
6) Operating cost compares favorably with water cooled condensers.
7) The first cost of air cooled condensers compares favorably with evaporative condensers and is less at capacities under 30 tons.

Mr. Nussbaum stated that control of head pressure when using a remote air cooled condenser is now accomplished by the use of a pressure actuated valve which bypasses hot gas to the liquid side of the condenser, causing the condenser to partially fill at low outside temperatures and thus reducing its capacity and maintaining a relatively uniform head pressure. He said that face velocity of air through the coil of an air cooled condenser is in the range of 500 to 600 fpm, limited chiefly by the noise problem, and that the air quantity required is approximately three times that required for a cooling tower.

The heated discussion that followed the presentations was a serious indication of the water conservation problem facing many sections of the country. Whereas water conservation methods have been mandatory in many parts of the country over the years, it is now noted that other sections where normally no restrictions have been in effect are considering control legislation.

Piping Papers Presented

. . . at recent ASME meetings

THE FOUR PAPERS on the subject of piping that are briefed here for the benefit of HPAC's readers are only a few of the many important papers that were presented at the recent meetings of the American Society of Mechanical Engineers.

Thermal Expansion of Piping

In the paper, Elastic Constants and Coefficients of Thermal Expansion of Piping Materials Proposed for the 1954 Code for Pressure Piping, by Rudolph Michel, he points out that there are gaps in our knowledge of the elastic constants for piping materials. For temperatures below 70 F, data are meager for many metals and alloys that are used in this range. For example, very little published data are available on elastic constants for wrought iron — up to its maximum allowable temperature of 750 F — although further investigations on this are being conducted.

Dynamic methods of determining elastic constants agree closely with static methods for temperatures where creep is negligible — below approximately one half the absolute melting temperature. Above this temperature, wide differences occur between the two methods. Elastic constants determined by static methods are recommended for use above the temperatures mentioned when making thermal stress computations of hot piping systems.

Such data are not only meager at present, but the method of making the static test for moduli at elevated temperatures has not been standardized. Rather large variations in results are obtained if different techniques are used.

Mr. Michel recommends that steps be taken to standardize the method of establishing moduli of metals at high temperatures. The points to be standardized are:

a) the number of test specimens to be used for each temperature,

b) the method for bringing the specimens up to temperature — whether loaded or unloaded,

c) the range of stress to be covered during test and

d) the length of time under load.

The available data have been tabulated in the paper. These data are proposed for inclusion in the 1954 edition of the Code for Pressure Piping. Only the tabulated data will be included in the code, and hence this paper explains the sources of the data and their probable accuracy as an aid to the users of the code.

Mr. Michel is head engineer, Bureau of Ships, Navy Department and is the chairman of Subgroup No. 2 of the ASA Committee B31.1 whose responsibility it is to prepare data on elastic constants and coefficients of thermal expansion of piping materials.

Fuel Gas Piping

In the paper, Installation of Fuel Gas Piping on Premises of Industrial Consumers, by E. L. Spanagel, he states that fuel gas piping on the premises of industrial consumers is partially covered in the code for Pressure Piping, ASA B31.1. However, the information in the code is not sufficiently detailed for practical application. This paper reports on the progress made toward the preparation of a comprehensive standard for such work. It is intended to cover proper methods and procedures for the design, installation and testing of piping systems for distributing fuel gas within the premises of an industrial plant.

The mechanical details of an industrial fuel gas piping system are not essentially different from those of any other piping system used in industry. Fuel gas piping must not be subjected to freezing or changing temperatures, and it must not be placed in cinder fill or other destructive soil without some form of corrosion protection. Also, it must always be located so that gas leakage may be readily detected. The procedures for testing, purging and locating leaks in a fuel gas system should be in accordance with those recommended by the American Gas Association.

Particular emphasis is devoted to the design and layout of the piping. Perhaps the most important factor in which there are more possibilities for error is in the determination of adequate pipe capacities. Several pipe sizing tables for different pressures are given, which would be helpful to the engineer in designing such a system.

Mr. Spanagel is manager of the commercial and industrial sales department of the Rochester Gas and Electric Corp., Rochester, N. Y.

Flexibility With Rigid Hangers

In the paper, Flexibility of Piping Systems Supported by Equally Spaced Rigid Hangers, by J. E. Brock, exact methods are developed for the analysis of single plane piping configurations in which long horizontal runs are supported on equally spaced hangers of the rigid type. Two important cases are treated and illustrated in detail.

When analyzing the flexibility of piping systems, it is customary to assume that the system of supports and hangers provides vertical upward forces exactly equal and opposite to the downward forces exerted by gravity. Furthermore, it is usually assumed that this equilibrium is maintained as the piping system suffers deformations due to thermal expansion.

If constant support spring hangers are employed and vertical deflections are small, it may usually be assumed that the support and gravity forces can be neglected in the flexibility analysis. However, if rigid hangers or ordinary spring hangers are used, this assumption is invalid. This may also be true even if constant support hangers are used.

Several piping arrangements lying in one plane and supported by rigid hangers are considered. The piping systems possess the following properties at the point of support:

a) the hangers exert no axial force on the pipe.

b) they prevent perpendicular deflection of the pipe in the plane of configuration and

c) they exert no moment on the pipe in the plane of configuration.

Such supports are widely used in practice. If the configuration is vertical, rigid hangers or roller supports exert constraints of this nature. If the configuration is horizontal, roller supports behave in this manner. In the case of the rigid hangers, it is presumed that the axial deflection is small compared with the length of the hanger rod—not over one-fifth of its length. Therefore, the arc of a circle in which the point of support swings does not exceed one-tenth the axial deflection. If the hanger rods are set so that they are vertical at a temperature halfway between the hot and cold extremes, the lift will not exceed 1/40 of the axial motion.

Mr. Brock is director of research, Midwest Piping Co., Inc. and has contributed several articles in the piping field which have been published in HPAC.

Piping Flexibility

In the paper, Piping Flexibility Analysis, by A. R. C. Markl, the consensus of the Task Force on Flexibility is presented. This group has been charged with reformulating Chapter 3 of Section 6 of the Code for Pressure Piping. The rules proposed by the Task Force are included in this paper and a discussion of them has been published in the November 1953 HPAC.

This paper also outlines various phases of the problem of providing flexibility in piping and the many difficulties in establishing a simple rational approach to its solution. Particular emphasis is devoted to the phenomena of plastic flow and fatigue which distinguish the behavior of piping systems under thermal expansion from the room temperature steady state problem. This leads to the concept of a limiting stress range rather than an allowable stress as the criterion of the adequacy of the layout.

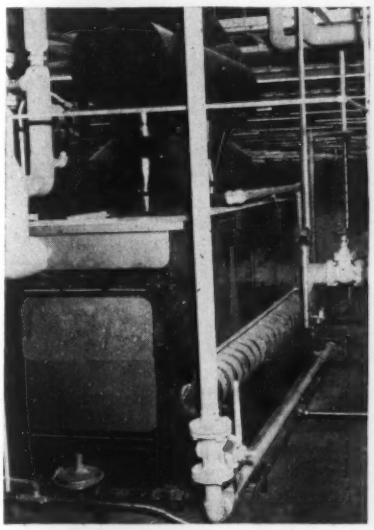
The proposed rules present an attempt by some of the leading piping engineers — gathered as a task force operating under Sectional Committee ASA B31.1 — to reduce the complex problem of providing adequate flexibility in a piping system to a few simple guide lines which reflect the latest advances in theoretical understanding and accumulated practical experience.

On reviewing the evidence, numerous gaps in our knowledge of the magnitude of certain properties entering into the problem have become apparent. On the other hand, not all the present knowledge available on certain phases could be utilized in framing the rules for the code because of the need to keep them simple. This has necessitated a weighing of the significance of the various factors and their effect on the overall accuracy of the prediction of reactions and stresses.

While the proposed rules represent the group's best effort, the interpretation of the facts given therein is not necessarily the only one possible. It is hoped that this paper will stimulate discussion by engineers at large and will uncover additional data not available to the group. Also, it is hoped this will ultimately lead to an improved formulation of the code, particularly with regard to the clauses intended to promote uniformity of practice and intelligent enforcement.

Mr. Markl is chief research engineer, Tube Turns, Div. of National Gas Cylinder Co. and is on the ASA Sectional Committee B31.1 which was charged with the task of reformulating Chapter 3 of Section 6 of the Code for Pressure Piping.

Boilers on Toilet Room Roofs at Big Plant



ONE OF THE 19 boilers that supply heat and domestic hot water at the Convair plant. A propane-air mixture is available if natural gas transmission is interrupted

NINETEEN GAS fired boilers installed on the roofs of toilet rooms in 40 acres of industrial buildings make the heating system at the Consolidated-Vultee Aircraft Corp., Pomona, Calif., one of the most unique completed last year. The manufacturing facility for production of guided missiles is also completely air conditioned.

The largest building has an 18 acre floor area. It is heated and domestic hot water is provided by ten boilers, each with a net rating of 1,212,300 Btu per hr. Nine other boilers are scattered throughout four other buildings.

All the boilers are installed on the concrete roofs of toilet rooms that are strategically spaced throughout the buildings. The roofs of the fully-enclosed rooms are about 10 ft above floor level. Six inches of reinforced concrete, plus 2 in. of magnesia block, separate the boilers from the ceilings of the rooms.

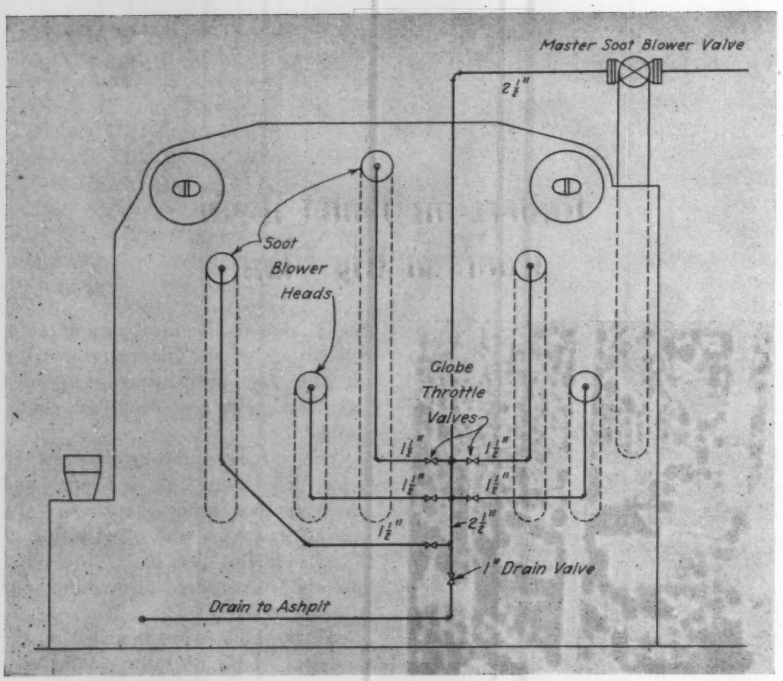
Water at 180 F comes from the boilers and is delivered to coils in the air conditioning system. These coils are in fan houses on the roofs of the plant buildings. Heat exchangers and storage tanks adjacent to the boilers assure an adequate supply of domestic hot water for use in the toilet rooms beneath the boilers.

[Photo courtesy National Radiator Co.]

ANYTHING CAN HAPPEN

Mac Helps an Operating Engineer on a Soot Blower Piping Problem

By Bill Dopp



"I'M SCRATCHING my head to find out what's going on in the soot blower system"

• *Almost anything can happen when you're in the engineering, operating, contracting or sales ends of the heating, piping and air conditioning industry. The objective of this more-or-less regular editorial feature in HPAC is to discuss practical problems that need solving — and ways to solve them.*

Bill Dopp has had 40 years of experience dealing with piping, including a long stretch of service as a sales engineer. He is devoting some of his present leisure to drawing on his many piping experiences.

This month our old friend, Martin MacVane, solves a soot blower piping corrosion problem for his friend, Jim Scott...

"YOU NEVER CAN tell what you are going to find under a smokestack," remarked Mac laughingly. "How in thunder did you get here?" He looked inquiringly at Jim Scott, an old friend he had not seen for several months.

Jim laughed, enjoying Mac's surprise. They had met in the little office of a dusty corn mill. "Didn't expect to find me out here in the sticks, did you? My wife's brother died and left her this, and there was nothing to do but come down here and run it. After six months I rather like it, too."

"Bet you are learning a lot of new things," said Mac. "These little places can offer a real liberal education."

Trouble In The Soot Blower

"Don't I know it," replied Jim. "Right now, for instance, I'm scratching my head to find out what's going on in the soot blower system. Maybe you can figure it out. Come on down, and take a look at it."

When they got to the boiler room, Jim led Mac to the side of the boiler. Pointing to the neatly arranged soot blower piping he said, "Mac, those valves and nipples won't last any time at all. When I came here, the whole thing was leaking like a sieve. I replaced the valves and most of the piping. That was just four months ago. Already, the valves are leaking, and you can see where some of the threads are cutting out, too." Jim shook his head. "I don't know what to do."

"Are the valves in the soot blower heads tight?", asked Mac.

"Yes, they are. I checked all of them. Had to grind one a little. They're tight, all right. Funny thing there, too — that boiler is three years old. Why don't those valves go out the same as these down here?" He pointed to the globe valves on the soot blower header.

"That's a good question," observed Mac. "Tell me exactly how you operate this setup." He looked the layout over thoughtfully as he listened to Jim's explanation.

"First, I open the master valve up

there," pointing above the boiler. "This is a 300 lb boiler, but we operate it at only 200 psi. With 200 psi on the header, I open the drain valve until the system gets hot and then I close it. There is a queer thing about the valve that was in there. It had a 1/8 in. hole drilled through the disc." Jim chuckled, "I put in a new valve."

Mac smiled — he was obviously puzzled. "Go on," he said.

"Well," Jim continued, "I open the head valve on the rear soot blower and then open the globe valve. I sweep the whole arc three or four times slowly and then close the head valve. After closing the globe valve, I take the next one and so on until I've blown the entire set. Anything wrong with that?," Jim looked at Mac challengingly.

"No," replied Mac, "but you haven't finished."

"What do you mean, I haven't finished?," Jim asked.

The Little Things Make Trouble

"How about the master valve and the drain valve?" Mac eyed his friend shrewdly. "Jim, whenever you start out to analyze a problem be sure you have all of the available facts. The secret to your answer may lie in some little insignificant, easily overlooked operation or fact. It's those little things that usually make all the trouble."

Jim's contrite expression made Mac smile, but he waited while Jim thought the matter over. "I just close the master valve and open the drain valve, that's all there is to it," he said.

"You're sure that all of the head valves are closed?," inquired Mac, as he looked around for a place to sit down. Spying an overturned nail keg he made himself comfortable and studied the boiler thoughtfully.

"I always make sure that the head valves are closed," said Jim. "After I've closed the master valve I usually try them to make sure."

"Positive that you don't open them even momentarily?," asked Mac sharply.

"Positive," replied Jim emphatically. "Why?"

Corrosion In The Lines

"Jim, the thing that corrodes soot blower lines and a lot of other lines, for that matter, is very weak sulphuric acid. Usually that gets into the soot blower lines through the heads. If the head valves are not closed, and you close the globe valves you will suck furnace gases into the piping as the steam condenses. These gases are loaded with sulphur as you know. Mixed with the moisture in the line they make a very weak and highly destructive sulphuric acid. I still suspect that you are not closing those valves tightly. A vacuum can pull gas through a pretty small opening."

"Try them yourself, if you don't believe me," said Jim sarcastically.

Mac did try the valves and the master valve which was also operated with a chain wheel. All of them seemed to be closed tight. He carefully examined the threads at the ends of the screwed brass globe valves and opened one of them to get a look at the stem. There was no doubt that severe corrosion was taking place. Mac was puzzled. "You're getting gas into this line, that's sure," he said. "If you actually do close those head valves as you say, then there must be some other source of it. I'm certain it doesn't come from outside the pipe." He paced up and down beside the boiler looking the place over as if he would find the answer hanging on a roof truss or on the wall. Finally, he turned to Jim and said. "You know, Jim, the trouble is not always where you expect it to be."

"What do you mean? I don't understand," Jim replied.

Acid Does the Trick

"I recall a case in a dyeing establishment where hundreds of dollars were spent replacing brass globe valves. These were in the steam lines to the dye vats. They were open lines used for heating the dye which was a slightly acid solution. The heating made a lot of racket so they throttled the valves pretty close. When the dye was hot, the steam was shut off until they were ready for the next batch of yarn. Believe it or not, those valves lasted less than a month. When we got to the bottom of the trouble, we found that the steam was condensing in the four feet of pipe between the top of the dye bath and the valve. That sucked the warm acid fumes up to the valve where they silently went to work to destroy the valves."

"I can see how that would be," observed Jim. "How did you cure that one?"

"He was blaming the trouble on the close throttling — which of course did some damage. The globes were in the line with pressure on top of the disc. At first the scoring was not enough to break the vacuum. That was what had to be done, however, so we just drilled a hole in the steam pipe on the side away from the stem and installed a 1/8 in. lift check valve on the end of a short nipple. The check was put in backwards, though. When the steam was on, it automatically closed. As soon as the steam started to condense, it opened just enough to break the vacuum and prevent the vapor from filling the pipe. The next lot of valves lasted for over two years." Mac grinned at the recollection. "The valve salesman on that beat did not like me for a long time," he said.

"Maybe that would work here," suggested Jim.

"We still don't know where that gas is coming from. Until we do, any remedy we try is just wild guess work, and that's no good." Mac was emphatic.

"I suppose you're right in that," said Jim. "What do we do now?"

Where Does the Drain Lead?

"Let's go over the whole thing again. Tell me once more exactly how you operate this thing."

Jim went through the story carefully, while answering questions that Mac kept interposing. Suddenly, Mac stopped him.

"Wait a minute, Jim. You say that you close the master valve and open the drain?" Mac eyed the boiler. "Where does that drain go?," he asked.

"Into the ashpit under the boiler," answered Jim.

"Oh! Let's take a look at that drain." They went over to the front of the boiler. Mac took a look at the line which terminated about a foot above the hot ashes in the pit. "Here's our trouble," he said, as he turned to Jim with an amused grin. "Don't you see what is happening?"

"You mean that gas is coming from the ashpit?," Jim seemed incredulous.

"That's right. You turn off the master valve and open the drain.

The water that has accumulated on top of the drain valve runs out all right, but as the steam condenses in the piping, something has to replace it. The vacuum simply pulls the pipe full of gas from the pit. This combining with the remaining moisture does the trick." Mac was completely satisfied now that he had the answer to the problem. Jim was not.

"Mac, I can't believe that the little gas that could be sucked up there would cause all of the trouble that I've had. It just doesn't make sense." Jim looked doubtfully at the piping on the side of the boiler. "Why, there can't be more than a couple of cubic feet of air in that system. And you're trying to tell me that is making enough acid to destroy all of those valves and the piping?" Jim appeared disgusted.

Sulphuric Acid Harms Piping

"All right, mister, just listen. I told you before, weak sulphuric acid is about as destructive a medium as you can get into piping. The weaker it is, the worse it seems to be. It takes time to get started in its work, but once it gets going things happen fast. This weak acid is almost a perfect electrolyte. Now every metal has a definite electrolytic potential. When two metals of different potentials are placed in the presence of an electrolyte, you get what is called electrochemical corrosion. One or the other of the metals begins to break down, leaving a rough surface. Then, you turn on the steam. Besides heating up the metal, you scour it with high velocity steam — presenting a new clean surface for the renewed attack of the acid. The result is a combination of erosion and corrosion which will eventually destroy almost anything." Mac warmed up to his subject. He was not going to be stopped here. Jim tried to interrupt, but Mac waved him down.

"On top of all of the sulphur gases, air is present. Don't think that air is harmless. In the presence of moisture, the oxygen in the air will attack iron and steel ferociously. With a clean surface and a little moisture, you can almost see the rust forming. That rust, of course, is destroyed iron or what the chemist calls iron oxide. Add sulphur to this combination, and you get a mixture of iron sulphite and iron oxide. Then too, sulphuric acid plays hob with the zinc in brass. All in all, you have a fine piping graveyard there." Mac stopped for a moment, "No, Jim, it's not only reasonable but inevitable."

"It's hard to believe that a small quantity of gas could do so much damage," Jim mused thoughtfully. "I'm not a chemist so it doesn't take long to get in over my head. I haven't any doubt now that you are right. The question is, what do I do about it?"

"For one thing, you get that drain out of the ashpit," replied Mac.

"I could put a vacuum breaker on the soot blower header too, like the one you used at the dye plant," suggested Jim.

"There are better ways than that," said Mac. "Of course you could keep pressure on the whole system. It would then always be hot, and even if the head valves leaked, your line would not pull back any gas. Since none of that pipe beyond the master valve is covered, though, you'd condense a lot of steam. That means you would have to put a trap on the drain and would be feeding costly heat into the boiler room all of the time."

"I wouldn't care about having hot pipes exposed alongside that boiler either," said Jim.

Hole In Drain Valve Necessary

"No, that's out," said Mac. "Do you remember the hole in the drain valve? — the one you replaced?," asked the gasket salesman.

"Yes, I've still got that valve around here somewhere. What about it?" Jim looked puzzled.

"Whoever put in this system intended that hole for a continuous drain. When your master valve is open and you are working the blowers, you are also condensing steam in that part of the system that is not working. With the drain valve closed, you take a chance of putting a slug of water into the next blower that you open. Such water doesn't do the head valve any good and will damage the blower tube by starting a cutting action at the openings."

"That's fine, but you have steam blowing out the drain all of the time you are working the system," observed Jim.

"That's exactly what deceived the designer," laughed Mac. "He found a very convenient place to put that steam — the ashpit. He never dreamed of what he was doing to his piping."

"Why not put a trap on that drain?," asked Jim. "That would solve the whole problem."

"Hold on, Jim." Mac grinned at the way Jim jumped at a solution. "Suppose one of your head valves leaked. If you had not closed the globe valve tight and the master valve was tight, you would create a vacuum and pull the gas into the system from the boiler."

"My mistake," laughed Jim.

"You said that you open the drain valve until the system warms up. All right, then you close that valve and go to work blowing the tubes. In the meantime, you're condensing steam. With a hole in the drain valve disc, you get rid of the condensate and have fairly dry steam for your operation. That hole also acts as a vacuum breaker when you are through. Even if you forget to open the drain valve, there would still be a way for the water to get out and the air to get in. But don't leave that drain where you can get gas mixed with the air."

"I'll find a place for the drain, all right," said Jim. "I'm going to overhaul the whole thing then."

"That's a good idea, Jim. I'd turn those globe valves around, though. Put the pressure on top of the disc. You will find that they will last longer. Still better, use a plug type disc valve, instead of the conventional valves you have there." Mac put up his hand as Jim looked interested. "Let's not get into that now. I've got to get going."

"Thanks a lot for the help, Mac. Are you still selling gaskets?," asked Jim.

"I surely am," Mac grinned.

"Come on up to the office. We'll fix up an order."

"With pleasure," answered Mac as they left the boiler room.

Sam Lewis Addresses Insulation Group

SAMUEL R. LEWIS, consulting engineer, member of HPAC's board of consulting and contributing editors, and author of our monthly Sam Lewis' Page, was the guest speaker at the luncheon which featured the one-day meeting of the Industrial Mineral Fiber Institute in Chicago last month.

What's a "Professional Engineer"?

COURT RULINGS on the requirements needed to obtain state standing as a practicing professional engineer are important to those in the heating, piping and air conditioning field. Fortunately, a recent case provides further enlightenment on the subject.

A young man in a city in the Southwest had charge of the design and installation of a particular type of heating system, belonging to a company that was owned largely by his family. As in other states and municipalities, his activities were governed by a legal requirement to the effect that heating and similar systems of a specified nature must be designed by a registered professional engineer.

Applied for Certificate

For this reason, the young man — let's call him Hand E. Smart — applied for a certificate of registration as such. His avowed aim was to comply with the statute and thus enable his company so to comply. We are led to infer that he was practically brought up on the merits and technical details of the heating system which his people indirectly controlled. At all events, he appeared with confidence before the state board of registration, despite the fact that he was not yet 21 years old and was not graduated from high school.

Smart pointed to his experience in "construction work" (which appeared to consist for the most part in activities connected with installation of his family's system). He claimed that the nature of his work required "application of engineering principles and data" as laid down by the courts. Our applicant therefore urged that he was entitled to a professional engineer's license under the relevant act.

Board Refused Him

Much to Smart's consternation, the board refused to grant him a license. As a next move, he appealed to the state's supreme court, asking that tribunal to issue "a writ of mandamus" compelling the state board of registration to issue the coveted paper.

In its decision upholding the board's refusal, the court laid down some useful principles clarifying the qualifications of a professional engineer within the meaning of the state's "engineering act" and like statutes in other states.

The pertinent paragraph in the act as cited by the supreme state tribunal reads:

". . . The practice of professional engineering within the meaning and intent of this act includes professional engineering service such as consultation, investigation, evaluation, planning, design or responsible supervision or construction or operation in connection with any public or private utilities, structures, buildings, machines, equipment, processes, works or projects, wherein the public welfare or the safeguarding of life, health or property is concerned or involved, when such professional engineering service requires the application of engineering principles and data . . ."

It will be noted that the above paragraph is somewhat more general in its provisions than the wording used by a midwestern court in a "professional engineer" case discussed in the January HPAC.

The act under consideration this month does not mention the application of "mathematical and physical sciences acquired by education and training", but only of "engineering principles and data". This omission makes the decision in our subject case the more surprising.

Training Required

Emboldened by the apparently liberal phrasing of the act, and confident of his practical skill, Hand E. Smart must have complained to the judges that the board's refusal could have sprung from no other objection than that of his tender years, for those dignitaries denied in their opinion that age was a factor.

The point at issue, said the court, was not the *age* at which a person could become a registered professional engineer, but rather his *qualifications*. Significantly, the opinion set forth that mere "construction work" by an applicant "wholly without training as to engineering principles and data" did not bring his experience within the stated requirements. Accordingly, the court ruled that this applicant had no right to a license under the act.

Taken in connection with previous and cognate decisions, this case demonstrates that neither practical experience nor a limited amount of mechanical knowledge can serve as qualifications for status and registration as a "professional engineer". Requirements include training as to engineering principles and data plus experience in work calling for their specific application.

[Note: While this discussion applies to an actual case, it should be remembered that legal rules vary in different states.]

William Hurd Hillyer, author of this regular feature, is a contributor to a number of banking and financial publications and has written several books on business. A former vice president of the Atlanta Trust Co., his work there gave him a practical legal background.

QUESTION OF THE MONTH

"Skating Rink Piping a Problem"

• *IF YOU DON'T HAVE the answer to a heating, piping or air conditioning problem, chances are someone else does — or can be helpful on part of it. That's the reason for HPAC's Question of the Month "idea exchange."*

I HAVE a question in connection with an outdoor skating rink. It is 85 x 185 ft. Pipes for the brine are embedded in concrete, and there is a cinder and gravel fill under the concrete slab. Expansion joints, made of copper, were installed when the slab was poured at a distance between 8 and 10 ft apart lengthwise of the rink. The copper expansion joints do not extend to the top of the slab, so the joints have been filled with cold tar and painted with aluminum paint.

There is a small building at the west end of the rink that shelters the refrigeration equipment. There are two compressors — one driven by a 40 hp motor and the other by a 100 hp motor. A total of 94 tons of refrigeration capacity is available.

The problem is that the ice melts over the expansion joints near the shelter in mild weather, but when the outdoor temperature drops again, the water will freeze on top but not all the way through. No doubt it freezes some on the bottom which leaves water between two layers of ice. As soon as skaters pass over these expansion joints, the ice breaks.

To help this situation, the ice and water are removed from these expansion joints and thin layers of water are applied so that it will freeze without air pockets. What causes the ice to melt over the expansion joints, and how can this nuisance be overcome? — W. C. RICHARDS, Formerly Chief Engineer, Phillips Academy.

C. T. BAKER, Consulting Engineer, offers the following comments as an explanation of the trouble that W. C. Richards has described concerning the outdoor skating rink:

I have given considerable study to the problem of the melting of ice at the expansion joints opposite the machinery room in the outdoor skating rink described by W. C. Richards. I offer the following as an explanation of the trouble. However, as there was no information given about the temperature of the brine entering and leaving the coils, thickness of the concrete slab above the cinder and gravel fill, the distance of the nearest pipe from the copper expansion joint, or the outdoor temperature, it is impossible to consider all of the factors that may be exerting influence on the troublesome problem.

It appears that meltage at these locations may be due to the temperature of the brine being too high to maintain the necessary rate of heat transfer at the point where meltage occurs to prevent thawing. Evidently, the material with which the joint is sealed at the top is a poor conductor and does not permit the brine to remove heat as rapidly as is necessary to prevent the ice from melting during periods when the outdoor temperature is above freezing.

If it would not be practical to remove the cold tar and substitute some other material, then it may be necessary to reduce the brine temperature sufficiently to overcome the insulating effect of the cold tar in the expansion joints. A greater flow of brine through the coils, if that is possible, might also help the problem.

I am assuming, however, that the brine flow rate is correct and that the inner surfaces of the coils are clean and free of foreign matter. It is also assumed that all pipe line strainers are cleaned regularly.

If there are no thermometers at the brine inlet and outlet connections, they should be provided at once. An accurate pressure gage should also be installed on the brine pump. In addition to this, a combination pressure and vacuum gage should be provided between the brine pump and the suction line strainer to indicate when the flow of brine to the pump is being reduced because of partially plugged up strainers.

With these essential instruments, it would be possible to learn a great deal about the operation of the plant and whether there are spots in the system that need to be corrected.

In the meantime, I suggest that the temperature of the brine being circulated be lowered and, if possible, that another type of filler be used to seal the affected expansion joints. — C. T. BAKER, Consulting Engineer.

READER ASKS —

How Can Fuel Consumption Be Estimated for Apartment Buildings?

"We are interested in obtaining data and information on fuel consumption for apartment buildings. We would like to have degree days correlated with fuel consumption in gal of oil, lb of coal and therms of natural gas, if possible.

"We realize that building construction is a major factor in this too, but there should be some means for taking this into consideration in order to accurately estimate fuel consumption.

"We would like to know of any actual performance data that has been assembled on this subject or any experience that has been gained in estimating the fuel consumption for apartment buildings."—H.P.

[You are invited to comment on this question, giving actual examples if possible. Address the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2].

F. G. CHADWICK —

"Different Rates of Firing Affect Boiler Water Level"

IN REPLY to the question in the December HPAC concerning what is a good method of piping for control-

ling three boilers, I would state that in my opinion, the Hartford loop will not maintain an equal boiler water level in all three boilers when they are on the line together. Different rates of firing will affect the water level in the three boilers.

Experience has proven to me that the method of feeding returns and makeup water into a boiler has to be by a more positive method. This can be accomplished by installing motorized or solenoid valves in the feed line to each boiler. These should be installed in the line close to the boiler on the outside of the check and stop valves. The motorized or solenoid valve should be operated by a pump control installed as directed by the manufacturer of such valves. The pump control not only operates the return pump but opens the motorized or solenoid valve at the same time when the water in the boiler drops below the predetermined level.

An automatic feeder should be installed on the outside of the receiver of the return pump in order to maintain a constant level of water in the receiver. By introducing makeup water into the receiver automatically, it will help to condition returns and also maintain a constant water level in the receiver of ample supply when the boiler calls for water.

A low water feeder should also be installed. This is a combination feeder and a low water cut off. This feeder not only feeds water to the boiler independent of the return pump, but it will cut off the burner in case of a low water level and prevent damage to the boiler.

With reference to starting boilers in sequence, pressure controllers should be installed on each boiler set at different pressures for operation of the burners. A limit control combined in the pressure controllers will stop the burners in case of excessive pressure. — F. G. CHADWICK, Mechanical Engineer, Hdq. First Army Engineers.

MARIO E. BAJANDAS —

"Protect Against Freeze-up in One of These Ways"

THIS IS MY REPLY to the question in the November HPAC about protecting cooling coils against freeze-ups.

If the water chiller is of the dry expansion type — where the refrigerant circulates through the coil of the chiller while water surrounds the coil — I suggest that any one of the following solutions be applied individually — or the combination of *b* and *c*.

a) Add the necessary amount of antifreeze to the circulated water.

b) Control the circulating pump starter so that it is interlocked with the compressor starter. This may be accomplished by installing a differential pressure switch in the water lines, so that the compressor cannot operate unless the chilled water pump is operating.

c) If the chiller has a built-in well in the shell, I would suggest that a conventional non-freeze control be installed in the shell of the water chiller. This control consists of a thermal bulb with two terminal wires and a coupling for locking it in place. The terminal wires are connected at the compressor starter in series with the dual pressure control.

If the water chiller is of the flooded type, it is suggested that only *a* and *b* be applied.—MARIO E. BAJANDAS, Mechanical Engineer.

Perimeter System Air Conditions New Airlines Terminal

A SINGLE FAN-COIL unit serves each three-window, 26-ft-wide bay of the concourse, an upper level area devoted mainly to office space

NEW YORK'S new $7 million East Side airlines terminal uses a new peripheral system of heating and cooling, involving a series of enclosures running along the four outer walls of a building with a fan-coil outlet under each window.

The terminal's peripheral air conditioning system, which makes up one of the four basic cooling, heating and ventilation systems in the three story, 200 ft x 400 ft building, is installed along the four walls of the concourse, an upper level area devoted chiefly to office space.

Each enclosure is approximately 26 ft long, the distance between the pillars of a three-window bay. A single fan-coil unit feeds warm or cool air through a duct to adjustable grilles located under each window in the top of the enclosure.

This means if a bay of similar size were to be partitioned off into individual offices, one enclosure could air condition three 9 ft wide sections.

The cooling and warming of the air is accomplished by chilled or hot water flowing through the fan-coil unit.

A 300 ton centrifugal compressor supplies the refrigeration. Steam for heating purposes is purchased from a nearby New York Steam plant.

Other sections of the building are air conditioned through separate systems which draw on the same central supply of chilled water for cooling. Recessed wall and ceiling ducts bring treated air to the rotunda (the main lobby), while other ducts supply the individual baggage rooms. The restaurant and other public facilities are air conditioned through branch systems.

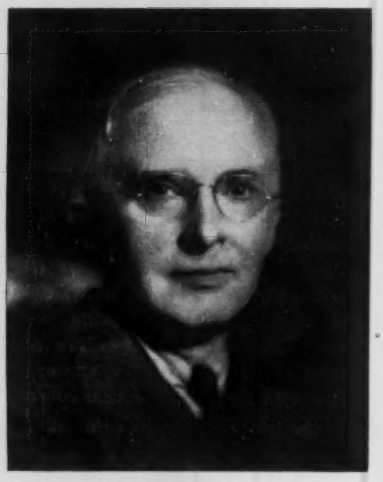
The entire air conditioning and ventilation system, excluding the basement garage, can deliver 250,000 cfm of air through its more than one mile (5500 ft) of ducts.

The garage, where the fleet of 100 airport coaches will be serviced and maintained, has an independently controlled set-up for heating and ventilation.

The terminal's heating, air conditioning and ventilation system was designed by the engineering firm of Sears & Kopf for John B. Peterkin, architect. Eugene J. Brandt & Co. was the air conditioning contractor.

SAM LEWIS' PAGE

"I Shouldn't Have Done It"



SAMUEL R. LEWIS, consulting mechanical engineer and a member of HPAC's board of consulting and contributing editors, comments informally each month on practical heating, piping and air conditioning problems. He tells about some of the things this month that he has done on past jobs that he won't do again

HERE ARE some things to think about when designing a mechanical plant for a large institution. The incentives for noting these items are all historical (that is, from my own experience!)

1 The space in the basement — called the machine room — allowed for the pumps, compressors, water heaters, pressure regulators, gage board and other equipment was far too small. I did not fight the architect hard enough.

2 The machine room was too high for the width and length of it. There are several superimposed layers of piping for steam, water, gas and refrigerant — all suspended from the overhead building structure. The hanger rods for these piping systems look like a denuded forest. I should have provided an intermediate set of steel beams from which at least part of these superimposed layers of piping could have been supported.

3 Air supply and exhaust for the machine room was omitted, and as a result, though all of the hot pipes are insulated, the room is unacceptably warm. Emphasis on ventilation for upstairs allowed me to be talked out of providing adequate ventilation for downstairs and the basement.

4 Since the main entrance doors are made of thick glass, they have no weather strips. The architect desired the gold fish bowl look, and eliminated vestibules. There was no concealment space for radiators near entrances. I hoped to compensate for this deprivation by using hot water panel heating in the entrance lobby floor and ceiling. This is hereby a testimonial for revolving doors in such places.

5 I employed pneumatic tubing from a special compressor for opening and closing various dampers and valves that were remote from the switchboard. I did not keep an armed marine on constant duty to prevent someone else from using the precious oil-free compressed air. Eventually, much of this air was swiped to clean instruments, to close doors and for many other services. This is a testimonial for a separate air supply for pneumatic temperature control.

6 The water in large hot water heating mains, is subject to rather rapid changes in pressure and temperature. I have learned from sad experience that it's essential to select expansion joints for such applications with even more care than for high pressure steam piping.

7 I called for canvas joints in the air ducts that connect the metal ducts to the fan housings, hoping to reduce the noise transmission. The canvas was installed, but my marine guard failed to shoot the contractor who painted and repainted the canvas. Canvas is cotton. Cotton when painted enough becomes almost as hard as iron. We reduced the noise by replacing the canvas and shooting anyone who approached it carrying a paint brush.

8 I specified that gate valves — where used on hot water — must not have the stems point lower than the horizontal. The reason for this is that sediment eventually can collect in the valve pocket during long intervals while the valve is closed. This accumulation, occupying the pocket in the valve bonnet reserved for the valve, can prevent opening the valve.

9 To burn any fuel requires a lot of air. Enlightened smoke prevention authorities insist that there shall be an air intake directly from outdoors for every apparatus that burns oil, coal or gas. This intelligent enforcement has reduced chimney smoke. Similarly, we must remove questionable heat, dust and odors such as those from industrial processes. Usually this removal is accomplished best by exhaust fans and ducts. One cannot get blood out of a turnip unless the blood is first put into the turnip. There is no luck connected with an attempt to remove heat and odor from an airtight room. A commensurate air supply to replace the air exhausted must be available, and this replacement air must be conditioned to something like the temperature and other qualities of the unpolluted air already in the room.

10 This same disposition of nature to abhor a vacuum appears continually in steam heating systems if the supply of steam — at atmospheric pressure or higher — shall be curtailed. The steam then condenses in the heat transmitters and pipes so that the pressure drops be-

low atmospheric. The ever present atmospheric pressure outside the heat transmitters then tries to force air into the system. Failing in this attempt, water is forced from the boiler back into the pipes. When the steam eventually is restored, turmoil and noise result if the steam meets the cool water. Effective help to combat this induced vacuum and to permit return of the condensate may come from a power driven vacuum pump. The following arrangement also helps to combat induced vacuum:

An equalizing pipe is connected from the return pipe main through a swing check valve that opens into the steam pipe. If the return pipe pressure is lower than the pressure in the steam main or in the boiler, this check valve will close, but if — due to induced vacuum — the pressure on the steam side should be lower than the pressure in the return side, this check valve will open and permit equalizing, so that condensate in the system may return due to its weight — unhampered by the air pressure above it.

11 I have in my own old home a former gravity circulating hot water heating system that as originally installed was superlative for its day. The radiator valves were of the vintage of 50 years ago, with rotary Corliss type gates. In later years I added a circulating pump and mechanical forced draft combustion apparatuses. The more rapid circulation induced by the pump, rendered the original radiator valves useless by closing them, and all had to be replaced. Determination of the size of the pin hole to be drilled through the closure member of a hot water radiator valve requires great mathematical ability. In one 40 story building heated by steam with a vacuum pump, the valve manufacturer made a mistake and furnished valves with disks drilled with tiny passages for hot water. Before this mistake was discovered, many hours were spent in an attempt to discover why the tenants couldn't shut off the radiators.

Why Higher Duct Velocities?

WHY DO ARCHITECTS and engineers use higher duct velocities? The reason is economics. An owner or prospective client comes to him and says that he wants such and such a kind of building and has so many dollars to spend. He wants X number of floors with a certain ceiling height and, of course, the building should be air conditioned.

The architect and engineer find that to build to the requirements, the budget will be exceeded. However, if the space for ductwork in the ceiling can be reduced, the height of the building can be less and the client given what he wants within sight of the budget. The ducts get smaller, air velocities are increased, and possibly the prime air is colder. The air conditioning contract is not decreased, nor is it increased. The saving is in the cubage of the building effected by reduction in the space required for the ductwork.

A good example of this is a new department store that was being built and was under construction before the air conditioning work was out for bids. Interior changes as required for store services made it impossible to hold to the original conventional duct design. The furred ceiling would have had to be lowered to accommodate the required ducts.

Instead, the job was redesigned and a semi-high-pressure system installed. Since this store was being built during a steel strike, aluminum sheets which we had in stock were used. Initial velocities of 3500 to 4000 fpm were used, and since the ductwork was square, we were a little disturbed by the thought of what would happen to the ducts under this higher pressure.

We made a mock-up of an 8 ft section of duct, approximately 48 in. by 24 in., cross broke the sides, and applied angle frames at the 4 ft sections. When air pressure was put inside the duct, the sides were extended approximately 3 in. at 6 in. of pressure.

We redesigned the angle frames, and cross broke the duct at the 4 ft points. On the next test, the sides were extended only approximately ½ in. in the center, with no break or rupture of the seams.

This ductwork was installed and sealed with blowpipe cement at all joints before and after making connections. It tested out with less leakage than a conventional system.

Sound absorbers were installed after the fan discharge, and high pressure ceiling outlets with sound boxes were used for introduction of the air to the sales areas. This job is very quiet in operation and gives excellent distribution without affecting the architectural design.

In another adjacent store, a semi-high-pressure system was also installed with less sound absorbers, and no sound boxes on the outlets. We used round pipe and tapped the outlets directly into the duct. This job is very successful and with a sound level below the normal store noise level.

Both of these systems were designed because of economic necessity. Even though our contracts were smaller, we made as much, if not more, profit than if we had taken our contract on the original design, and we also helped the owner stay within his budget and proceed with the entire job.

On the International Amphitheater job in Chicago, which was air conditioned for the Republican and Democratic national conventions, we found that even though the air requirements were greatly increased, we could use the major portion of the old system because the ductwork had been designed for low velocities. We reversed the old system so we could supply overhead and returned the air under the balconies. A major operation was performed quickly and at a minimum of cost.

The possibilities of modern ductwork are not limited to new buildings. Many an impossible job can be made a contract with a little careful thought and application.

Velocities are being used today that were unheard of a few years ago, and they are doing a very excellent job. However, as in the case of the automobile, we should proceed with caution; just because 200 hp is available, it is not necessary that we use it all the time.—LAWRENCE O. PAUL, Vice President, Narowetz Heating and Ventilating Co.

DATA SHEET

Weather Bureau Issues New Degree Day Normals

THESE NEW NORMAL degree day figures are based on U. S. Weather Bureau records for the 30 year period 1921 to 1950. They are computed on the standard 65 F base.

Further information about them was given on page 133 of the November HPAC, where the figures for Alabama — Illinois were published. The data for Indiana — New Mexico appeared in the December HPAC, and for New York — Texas in the January HPAC.

These figures are concluded this month.

NEW NORMAL DEGREE DAY figures, monthly and seasonal
AP indicates airport station, CO city office station

Station	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Annual
UTAH													
Blanding	1190	913	800	510	272	73	0	0	100	409	792	1079	6138
Milford AP	1277	955	800	516	269	77	0	0	114	462	828	1147	6445
Salt Lake City AP	1194	885	741	453	233	81	0	0	88	381	771	1039	5866
Salt Lake City CO	1119	857	701	414	208	64	0	0	61	330	714	995	5463
VERMONT													
Burlington AP	1460	1313	1107	681	307	72	19	47	172	521	858	1308	7865
VIRGINIA													
Cape Henry CO	698	636	512	267	60	0	0	0	0	120	366	648	3307
Lynchburg AP	846	722	584	289	82	5	0	0	49	236	531	809	4153
Norfolk AP	729	644	500	265	59	0	0	0	9	152	408	688	3454
Norfolk CO	679	602	464	220	41	0	0	0	5	118	354	636	3119
Richmond AP	828	708	550	271	66	0	0	0	33	210	498	791	3955
Richmond CO	787	675	529	254	57	0	0	0	31	181	456	750	3720
Roanoke AP	840	722	588	289	81	0	0	0	50	233	543	806	4152
WASHINGTON													
Ellensburg AP	1268	949	753	504	296	105	13	17	176	496	849	1116	6542
Kelso AP	856	652	605	453	316	173	85	84	186	409	636	784	5239
North Head L.H. Resvn.	704	585	598	492	406	285	239	205	234	341	486	636	5211
Olympia AP	868	700	660	498	338	183	91	83	207	434	645	794	5501
Omak	1352	1061	781	453	222	59	0	46	194	533	921	1212	6834
Port Angeles AP	772	652	645	519	422	297	233	226	303	459	603	719	5850
Seattle CO	753	602	558	396	246	107	49	45	134	329	540	679	4438
Seattle-Tacoma AP	862	675	636	477	307	155	75	70	192	412	633	781	5275
Spokane AP	1243	988	834	561	330	146	17	28	205	508	879	1113	6852
Stampede Pass	1280	1064	1063	837	636	438	251	260	414	701	1002	1203	9149
Tacoma CO	797	636	595	435	282	143	66	62	177	375	579	719	4866
Tattosh Island CO	713	610	629	525	437	330	295	288	315	406	528	648	5724
Walla Walla CO	1023	748	564	338	171	38	0	0	93	308	675	890	4848
Yakima AP	1181	862	660	408	205	53	0	7	150	446	807	1066	5845
WEST VIRGINIA													
Charleston AP	887	750	632	310	110	8	0	0	60	250	576	834	4417
Elkins AP	1017	910	797	477	224	53	9	31	122	412	726	995	5773
Huntington CO	837	728	570	251	85	5	0	0	35	210	549	803	4073
Parkersburg CO	949	826	672	347	119	13	0	0	56	272	600	896	4750
Petersburg CO	967	820	667	384	133	14	0	5	72	308	654	942	4966
WISCONSIN													
Green Bay AP	1516	1336	1132	696	347	107	32	58	183	515	945	1392	8259
La Crosse AP	1528	1280	1035	552	250	74	11	20	152	447	921	1380	7650
Madison AP	1423	1207	1008	579	272	82	13	31	150	459	891	1302	7417
Madison CO	1417	1207	1011	573	266	79	10	30	137	419	864	1287	7300
Milwaukee AP	1336	1142	983	621	351	109	20	32	134	428	831	1218	7205
Milwaukee CO	1302	1117	961	606	335	100	11	24	112	397	795	1184	6944
WYOMING													
Casper AP	1324	1095	1011	660	381	146	13	24	231	577	951	1225	7638
Cheyenne AP	1225	1044	1029	717	462	173	33	39	241	577	897	1125	7562
Lander AP	1494	1179	1045	687	396	163	7	23	244	632	1050	1383	8303
Rock Springs AP	1457	1182	1110	735	443	193	20	32	266	648	1038	1349	8473
Sheridan AP	1392	1170	1035	645	387	161	27	41	239	578	957	1271	7903

Heating, Piping & Air Conditioning

THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

JOURNAL *SECTION*

Cooling A Small Residence Using A Perimeter-Loop Duct System†

by D. R. Bahnfleth*, C. F. Chen**, and H. T. Gilkey***

SUMMARY — The results presented in this paper were obtained in connection with the 1953 summer cooling investigations conducted in Warm Air Heating Research Residence No. 3 at the University of Illinois. Performance data are given for a 2-ton mechanical condensing unit connected to a perimeter-loop system in which the 6-in. diam ducts were buried in the concrete floor. The perimeter-loop system had been designed and used for heating studies conducted during the winter of 1951-52. Studies were made with the blower operated both continuously and cycled with the compressor. No ventilation air was introduced mechanically.

A room-air temperature rise of less than 1.5 deg occurred on a day when outdoor design conditions were exceeded and the unit operated at one-half its rated capacity. On a design day, with the unit operating at two-thirds its rated capacity, the control temperature of 75 F was maintained within the limits of the thermostat differential. At no time were floor-surface temperatures lower than the corresponding room-air dew-point temperature. The air distribution in the living zone was satisfactory with no apparent drafts caused by delivery of conditioned air from floor registers placed underneath the windows at the outside walls. Data for time lags in heat flow, and measured values of heat flow in uninsulated frame walls are included.

PREVIOUS INVESTIGATIONS[1-9] in summer cooling were conducted in Warm Air Heating Research Residence No. 1 during the summers of 1932 through 1938, and 1940. During the summer of 1952 a series of summer cooling investigations[10] was begun in Warm Air Heating Research Residence No. 2. Both of these residences were of tight frame construction and had basements. Because of the increasing use of year 'round air conditioning in homes equipped with perimeter heating systems, it seemed advisable to begin summer cooling studies in Research Residence No. 3, which is a low cost, basementless residence with a concrete slab floor.

The principal objectives of this investigation were:

1. Determination of the cooling load and its hourly variation when cooling Research Residence No. 3 under both day and night conditions.
2. Determination of the time lags in heat flow through the walls and ceiling.
3. Comparison of the actual cooling load with the cooling load calculated according to the procedure outlined in THE GUIDE, 1952.[11]
4. Determination of the characteristics of the warm-air perimeter-loop system when used as a distribution system for summer air conditioning.
5. Determination of the operating characteristics of the mechanical condensing unit installed in the Residence.

Description of Residence

Residence No. 3 is a single-story, low cost home with a concrete slab floor. It is of standard frame construction, and has a relatively large amount of glass area. The south exposure is shown in Fig. 1. The walls are uninsulated, but the ceiling is insulated with 3⅝ in. thick batt-type mineral wool insulation. The exposed wall section consists of a double course of cedar shingles, building paper, shiplap sheathing on 2-in. x 4-in. studs, ½-in. gypsum

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[1]Exponent numerals refer to References.

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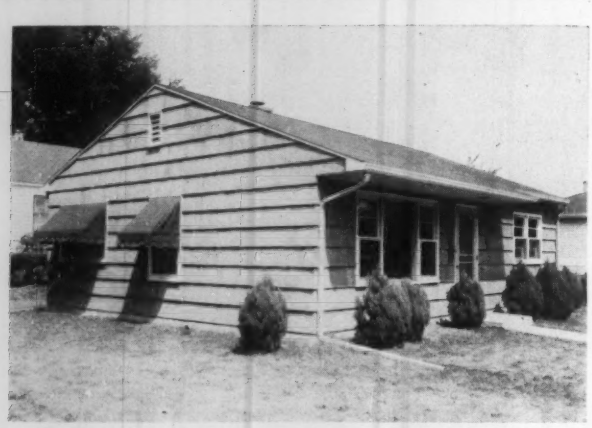

Fig. 1—Southwest view of Research Residence No. 3

board with aluminum foil backing and a simulated plaster finish. The attic is vented by louvered openings in the gable ends. The calculated coefficients of heat transmission U for the walls and ceiling are 0.21 and 0.07 Btu per (hr) (sq ft), respectively. Except for one fixed picture window, well-fitted double-hung wood-sash windows are used throughout. The windows are not weatherstripped nor are they equipped with storm sash, but those on the east and west exposures are shaded by canvas awnings. The doors are of conventional wood and glass construction. The south exposure of the living room is shaded by a 3-ft roof overhang; the remainder of the south wall and the north wall are shaded by 1-ft roof overhangs.

The floor-slab construction consists of a 4-in. fill of coarse graded gravel placed on the original grade, a heavy duplex-paper vapor barrier (dampproofing membrane), and 4 in. of concrete. The insulation at the edge of the slab consists of 1-in. asphalt-sheathed glass fiber insulating board placed against the footing wall and extending downward 12 in. from the top of the slab.

A floor plan of the residence is shown in Fig. 2. The inside dimensions are 24 ft x 32 ft, and the corresponding floor area is 768 sq ft.

The cooling load of the structure, except for the windows, was calculated[11] by the sol-air temperature method. The heat gain through the windows was calculated using the tables recommended in THE GUIDE. The infiltration load was based on a wind velocity of 10 mph and the actual linear feet of crack around the doors and windows. Table 1 gives a summary of the room dimensions and volumes, and a compilation of the calculated cooling load for each room is given in Table 2. The cooling load calculations were based on outdoor design conditions of 95 F dry bulb and 76 F wet bulb, and indoor conditions of 75 F dry bulb and 62.5 F wet bulb (50 percent relative humidity). The maximum calculated cooling load on a design day was 19,522 Btu per hr at 3 p.m. CST. The design heat loss of the residence for an outdoor temperature of −10 F and an indoor temperature of 70 F was about 51,600 Btu per hr when using the perimeter-loop duct system. The residence was furnished but unoccupied during the studies.

Equipment and Instrumentation

Cooling Unit: The cooling unit was a separate unit installed in the utility room of the residence and occupied a floor area of 22 in. x 36 in. For the purposes of this investigation the counterflow gas-fired furnace used during previous heating investigations[12] was removed from the residence. The conditioned air was circulated by the forward-curved blade centrifugal fan (10-in. diam, ¾ length wheel), hereafter called a blower, which was mounted integrally in the cooling unit, and was driven by a ½ hp motor. The air was drawn through the return-air duct into the cooling unit, through a filter, and then through the evaporator and to the blower by which it was forced through a downcomer into the subfloor plenum. The filter, cooling coil, and the blower were located in an insulated compartment and were thus isolated from the condensing unit in the lower half of the housing.

The rated capacity of the conditioner was 24,000 Btu per hr under

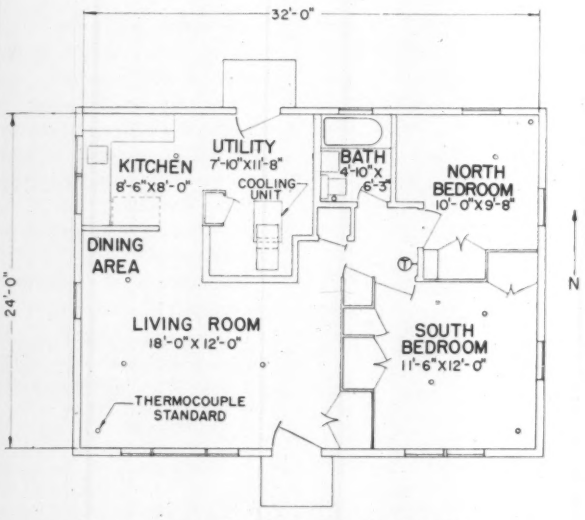

Fig. 2—Floor plan of Research Residence No. 3

ASRE Standard inlet air conditions of 80 F dry bulb and 67 F wet bulb entering the cooling coil and 95 F water leaving the condenser. The semi-hermetic compressor was directly connected to a 220 volt single phase 2 hp motor. Both the compressor motor and the double-tube condenser were water cooled. The refrigerant used was dichlorodifluoromethane.

Duct System: The perimeter-loop system used during the investigation was the same as that used during previous[12] heating investigations. The loop system[13] consisted of a 6-in. diam duct embedded in the concrete slab in the form of a single loop around the periphery of the floor and five 6-in. diam feeder ducts connecting the perimeter loop to a subfloor plenum as shown in Fig. 3. The top of the feeder ducts was 6 in. below the floor surface at the plenum and sloped upward to the junction with the perimeter loop which was 2 in. below the floor. The air was delivered to the rooms through nine 4-in. x 14-in. straight-vaned floor registers located under the windows at the outside wall. The air was returned to the unit through one return-air grille (14 in. x 30 in.) located high in the north wall of the living room.

Instrumentation: There were 303 copper constantan thermocouples installed in the residence; 208 of these were of 24-gage wire and the remaining 95 were of 34-gage wire. Air temperatures were measured at four levels, at positions indicated by small circles on Fig. 2. Floor-surface temperatures were measured at 118 points. In addition, temperatures were measured in the attic, in the ground under the slab, in the cooling unit and the air distribution system, on the interior and exterior surfaces of the residence, and in the outdoor air. Wet bulb temperatures were measured by thermocouples made of 24-gage constantan and 36-gage copper wire. All of the thermocouples installed were connected to an indicating potentiometer by a system of rotary selector switches. A continuous record of 18 temperatures could be made by means of two recording potentiometers. The temperature measuring instruments were located in a garage adjacent to the residence.

Five heat-flow meters were installed at various locations in the residence. The meters installed in the walls were embedded in the gypsum wall board 60 in. above the floor, and were covered with a thin coat of plaster. The plaster was then painted to conform to the color of the room. The heat-flow meter installed in the ceiling was located between the room side of the insulation and the attic side of the gypsum ceiling board.

Continuous records of solar intensity, outdoor-air dry and wet bulb temperatures, and wind velocity were made. The wind direction was recorded at the times when temperature observations were made.

Experimental Conditions

Four series of studies were conducted in the residence during the cooling season. The series designations and controlled variables are as follows:

Series	Date	Controlled Variables
A-1	June 24 to July 19	Blower operated continuously; capacity approximately one-half of rating.
B-1	July 25 to Aug. 6	Blower cycled with compressor, capacity approximately one-half of rating.
A-2	Aug. 21 to Aug. 31	Blower operated continuously; capacity approximately two-thirds of rating.
B-2	Aug. 7 to Aug. 20	Blower cycled with compressor; capacity approximately two-thirds of rating.

The air-flow rate through the cooling unit was approximately 600 cfm, or 300 cfm per rated ton of refrigeration. No ventilation air was introduced mechanically into the residence. The thermostat was set to maintain a temperature of 75 F at the 30-in. level in the house. No attempt was made to control humidity.

Because the draperies were open, the only shading of the windows of the residence was provided by the previously mentioned awnings and roof overhang. The doors and windows remained closed throughout all studies. The residence was completely furnished but unoccupied.

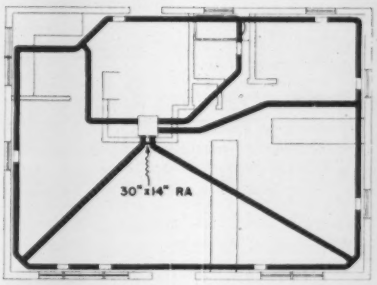

Fig. 3—Perimeter-loop duct system installed in residence

Floor registers — 4 in. x 14 in.
All ducts 6 in. diameter

Test Procedure

Temperatures of room air, outdoor air, floor surface, and interior and exterior wall surfaces were recorded daily at 3:00 p.m. CST, near the time that the peak load occurred. Power consumption, operation time and water consumption of the cooling unit were recorded each day at 5:30 a.m. CST the time selected to start the 24-hr test day.

Special studies of from 24 to 72 hr duration were made periodically for all four test series. These studies were made during periods of clear hot weather to determine: (1) Time at which the maximum load was imposed on the residence and, in turn, on the cooling unit; (2) Time lag of the heat flow through the walls; (3) Effect of the length of unit operating cycles on the floor-surface temperatures; (4) Effect of continued hot weather on the cooling load. Temperature and heat-flow observations were recorded hourly for approximately 18 hr of each day during the special-study periods.

Determination of Actual Cooling Load

The actual cooling load of the residence was determined by a heat balance which consisted of three components: (1) Heat removed from the conditioned air in the evaporator, (2) Heat absorbed by the condenser

Table 1—Data for Research Residence No. 3

A.	Heat Transmission Coefficients, Btu per hr (sq ft) (F deg.)	*U*
	Uninsulated Frame Wall	0.21
	Insulated Ceiling, with 3⅝ in. mineral wool insulation	0.07
B.	Infiltration Factors, cu ft per hr (ft of crack)	*I*
	Doors, no storm door	69
	Windows, no weatherstripping, no storm sash	21
	Fixed Window in Living Room	8

C. Room Dimensions,[a] Ceiling Area, Volume and Glass Area

Room	Dimensions	Ceiling Area Sq Ft	Exposure	Net Wall Area Sq. Ft	Glass Area Sq Ft	Volume Cu Ft
Living Room	18 2 x 12 0	251	West	117	11	2,008
	8 6 x 4 0		South	87	58[b]	
Closet	4 0 x 2 4	9	South	19	0	72
South Bedroom	12 0 x 11 6	138	East	87	9	1,104
			South	73	19	
Closet	6 0 x 2 4	14				112
Closet	4 0 x 2 4	9	East	19		72
North Bedroom	9 8 x 8 0	92	North	71	9	736
	6 3 x 2 3		East	68	9	
Closet	4 0 x 2 4	9				72
Bath	6 3 x 5 5	34	North	39	6	272
Utility	12 0 x 8 0	96	North	46	18[b]	768
Kitchen	8 4 x 8 0	67	North	65		536
			West	45	19	
Hall	7 8 x 5 8	44				352
Closet	2 4 x 2 0	5				40
Totals		768		736	158	6,144

[a]Ceiling heights of first story — 8 ft.
[b]Includes area of outside door which is of light wood panel and glass construction.

cooling water, and (3) Heat equivalent of the power input to the compressor.

Since a detailed explanation of the procedure of the heat balance was published in a previous paper,[10] only a brief description is presented in the following discussion.

It was assumed that heat absorbed by the cooling water was the sum of the heat absorbed by the refrigerant in the evaporator and the heat equivalent of the power input to the compressor. The condensing unit housing was completely insulated and the compressor motor was cooled by the condenser cooling water. The actual cooling load could then be found by subtracting the heat equivalent of the power input to the compressor from the heat absorbed by the condenser cooling water. The former could be evaluated by converting the power consumed by the compressor into its heat equivalent, while the latter could be found by knowing the temperature rise and the flow rate of the cooling water.

The actual cooling load was also calculated from the sensible and latent heat removed from the conditioned air. The sensible load was calculated from the air-flow rate and the air-temperature drop through the evaporator coils, and the latent load was found by measuring the quantity of water condensed from the conditioned air. The differences between the cooling loads as evaluated by these two methods for Series A-1, B-1, and B-2 were found to be within 4 percent. This difference could not be determined for Series A-2 because the continuous blower operation and frequent compressor operations resulted in little or no condensate being drained from the cooling unit. Typical operating data representing all test series are shown in Table 3. These data were taken from the daily 3:00 p.m. CST observations.

Some difficulty would be experienced in comparing the measured condensation rate with that calculated using the entering and leaving air conditions and the air-flow rate. The discrepancies result from such factors as moisture storage on the coil, the time element involved in the readings, and errors in measuring the wet-bulb temperatures. The measured condensation rate was based on the moisture collected during a one-hr time interval; the temperatures tabulated were instantaneous readings taken at the beginning of the compressor cycle.

Time Lags

The time lags in heat flow between the outer and inner surfaces of the walls and ceiling of a residence are important in that they may determine the time of maximum cooling load. Time lag is defined as the in-

Table 2—Compilation of Calculated Cooling Load for Research Residence No. 3

A. Maximum Load (Conducted and Transmitted) at 3 p.m. CST, Btu per hr

Room	Windows	Exterior Walls	Ceiling	Total
Living Room	2,910	1,630	1,040	5,580
Closet	[a]	[a]	[a]	[a]
South Bedroom	1,452	1,041	640	3,133
Closets (2)	[a]	[a]	[a]	[a]
North Bedroom	567	616	593	1,776
Closet	[a]	[a]	[a]	[a]
Bath	222	173	135	530
Kitchen	1,520	597	266	2,383
Utility	665	203	382	1,250
Hall	[a]	[a]	[a]	
Closet	[a]	[a]	[a]	[a]
Totals	7,336	4,260	3,056	14,652

B. Grand Total Load, Btu per hr

	Sensible	Latent	Total
Heat gain to rooms	14,652	—	14,652
Infiltration load	1,125	1,445	2,570
Load of blower (600 cfm)	525[b]		525
Total for system			17,747
10 percent miscellaneous gains			1,775
Grand total			19,522

[a]Cooling load for these rooms included with larger adjoining rooms.
[b]Measured load.

Table 3—Typical Operation Data and Results at 3:00 p.m. CST

Series[a] Date	Unit	A-1 June 30	A-2 August 25	B-1 August 3	B-2 August 14
1. Length of time unit had operated continuously before readings,	hr	6.67	0.22	6.42	0.23
2. Outdoor Air Conditions					
Dry Bulb,	F	94.8	92.0	94.7	90.0
Wet Bulb,	F	80.4	68.4	76.9	71.7
Relative Humidity,	%	54.0	30.0	45.0	42.0
Dew Point,	F	75.7	55.9	70.2	63.3
Humidity Ratio[b]		0.01925	0.00950	0.01590	0.01248
Wind, (Direction)—(Velocity, mph)		S-4	S-4	WSW-6	W-6
3. Indoor Air Conditions					
Dry Bulb,	F	76.5	75.1	75.9	75.0
Wet Bulb,	F	67.0	62.6	64.9	62.3
Relative Humidity,	%	61.5	50.0	56.0	49.0
Dew Point,	F	62.3	55.2	59.0	54.7
Humidity Ratio[b]		0.01204	0.00927	0.01068	0.00910
4. Condition of Air Entering Coil					
Dry Bulb,	F	77.7	75.7	77.0	75.8
Wet Bulb,	F	67.0	64.1	63.5	60.4
Relative Humidity,	%	58.0	53.0	47.0	41.0
Dew Point,	F	61.7	57.6	55.7	50.3
Humidity Ratio[b]		0.01175	0.01013	0.00947	0.00771
5. Condition of Air Leaving Coil					
Dry Bulb,	F	61.5	55.4	59.0	50.5
Wet Bulb,	F	59.2	53.9	57.0	48.5
Relative Humidity,	%	88.0	90.0	88.0	86.0
Dew Point,	F	57.8	52.8	55.6	46.6
Humidity Ratio[b]		0.01020	0.00848	0.00944	0.00673
6. Air Temperature Drop Through Coil,	F deg	16.2	20.3	18.0	25.3
7. Temperature of Cooled Air Leaving Registers (Average of all)	F	67.0	65.0	65.4	63.0[c]
8. Air Temperature Rise, F deg					
Unit to Subfloor Plenum		1.3	4.2	2.7	4.1[c]
In Feeders,		2.2	3.0	1.8	3.9[c]
In Loop,		2.0	2.2	1.9	3.5[c]
9. Floor-Surface Temperature, (Average),	F	73.4	70.5	72.6	71.3
10. Flow Rate of Recirculated Air,	cfm	596	598	605	610
11. Moisture Condensed from Air,	lb/hr	0.69	[d]	0.8	1.53
12. Heat Absorbed by Cooling Coil,	Btu per hr				
Total		10,910	[d]	12,350	17,870
Latent		750	[d]	880	1,650
Sensible		10,160	12,800	11,470	16,220
13. Water Temperature,	F				
Entering Condenser		58.3	58.5	60.5	58.5
Leaving Condenser		71.0	79.6	96.0	79.7
Rise		12.7	21.1	35.5	21.2
14. Flow Rate of Condenser Water					
	gpm	2.72	2.15	1.06	2.18
	lb/hr	1360	1075	532	1090
15. Heat Absorbed by Water in Condenser,	Btu/hr	17,270	22,700	18,850	23,100
16. Heat Equivalent of Power Input to Compressor,	Btu/hr	6,960	6,820	6,960	7,030
17. Net Cooling Load, (Item 15 — Item 16)	Btu/hr	10,310	15,880	11,890	16,070

[a]Series A-1 and A-2, blower operated continuously; Series B-1 and B-2, blower cycled with compressor.
[b]Pounds water per pound dry air.
[c]Data taken from August 15, 1953. Indoor conditions were similar to those for August 14, 1953.
[d]No condensate collected with continuous blower operation and with unit cycling frequently.

terval between the times of occurrence of the exterior and interior maximum surface temperatures, assuming that constant conditions are maintained within the conditioned space. The time lags, as thus defined, are affected by many variables besides the thermal properties of the materials used in the construction of a wall. Such factors as the direct solar radiation through the windows will affect the interior surface temperatures and consequently the apparent time lags. The maximum values of surface temperature and heat flow and their times of occurrence for each exposure of the residence are shown in Table 4. The last column of this table shows the apparent time lags for each exposure of the residence. The values were obtained from curves in which hourly readings of surface temperatures and heat flow had been plotted.

In Table 4 it can be seen that the observed time lags varied from day to day and from wall to wall throughout the cooling season. This inconsistent variation can be attributed to unsteady weather conditions and to the orientations of the walls. The exterior surface temperatures are affected by changes in wind velocity and direction, solar intensity, and outdoor temperature. Variation in time lags occurred because the interior surface temperatures are neither immediately nor directly affected by changes in the exterior-surface temperatures. The time lag for any given exposed wall section will also be affected by the orientations of the other exposed walls in the room, and by direct and diffuse solar radiation through the windows.

The radiation received from the other exposed wall sections and the windows can cause the interior surface temperature to reach a maximum at different times depending upon the time of peak load on the other wall sections. Thus, the time lag for an east wall of a residence should be relatively consistent since it will not be affected appreciably by the heat gains through the other exposed surfaces. That this is true is shown in Table 4. The time lags measured for the east wall during the four test series were 2.0, 0.9, 1.8, and 2.1 hr. The time lag of 0.9 hr, measured on August 25, was the result of the late time at which the maximum exterior surface temperature apparently occurred. Had the peak occurred at 9:00 a.m. as it did in the other two studies in August, the measured lag for the east wall on this day

would have been 1.9 hr. The measured time lag variations for the other exposures were greater because of the effect of the heat gains through the other exposed surfaces from which they received radiation.

An average time lag for each exposed wall and the ceiling can be determined from Table 4 for the four days listed. These averages for the east, south, west, and north exposures were 1.7, 1.4, 1.2, and 1.3 hr, respectively. The average time lag for the ceiling was 2.1 hr for the four days. Throughout the investigations, the temperatures of the exterior and interior surfaces of the west wall of the residence were recorded continuously. The time lag for the west wall of the residence could then be determined for each day on which significant data were recorded. The average time lags for the west wall determined for 14 days during Series A-1 and 13 days during Series B-1, were 1.0 and 1.1 hr, respectively. These averages are in fair agreement with the average of the four days previously mentioned.

Comparison of Calculated and Measured Heat Flows

Figs. 4, 5, and 6 show comparisons between the measured and calculated heat flows for two walls and the ceiling of the residence. Because the overall coefficient of heat transfer for the stud space of an uninsulated wall section varies only slightly from that of the entire uninsulated wall, no adjustments in the calculated heat-flow rates were made for the comparisons of heat flow through the walls. In the case of the ceiling, the heat-flow meter measured the heat flow through an insulated section of the ceiling. Thus, it was necessary to correct the calculated heat-flow rates through the ceiling so that they were based on an overall coefficient of heat transmission U of 0.06 Btu per (hr) (sq ft) rather than the value of 0.07 Btu per (hr) (sq ft) used for the cooling load calculations.

In a previous investigation[10] it was shown that, in general, the measured heat-flow rate was less than the calculated rate when the wall was not exposed to direct solar radiation. Further, it was shown that when a wall was exposed to direct solar radiation, the measured value was greater than the calculated value. These same general conclusions can be drawn from Fig. 4 and from similar studies made on the north and west walls of the residence. In Fig. 4 it can be seen that in the morning from 6 a.m. to 11:30 a.m. when the east wall received direct solar radiation, the measured heat flow was greater than that calculated. Throughout the rest of the day, while the wall was in the shade, the measured heat flow was less than that calculated by the sol-air temperature method. The maximum measured heat flow of 10.87 Btu per (hr) (sq ft) was 11.7 percent greater than the maximum calculated heat flow of 9.60 Btu per (hr) (sq ft) for the uninsulated east wall. In the case of a fully insulated west wall exposed to direct solar radiation, it has been shown[10] that the maximum measured heat flow was 36 percent greater than the maximum calculated heat flow.

The roof-attic-ceiling combination was treated as a flat roof when calculating the cooling load. Recognizing that the sol-air temperatures for horizontal surfaces did not apply directly to such a combination, these sol-air temperatures were redueed by 22 percent. As shown in Fig. 5, this assumption resulted in a calculated heat flow less than the measured heat flow. This would be more evident if the calculated heat flow curve were shifted to correct for the difference in the predicted and measured time lags. The maximum measured heat flow of 3.96 Btu per (hr) (sq ft) was 5 percent greater than the maximum calculated heat flow of 3.75 Btu per (hr) (sq ft). In a previous investigation,[10] when the same assumptions were made in calculating the heat flow through the ceiling, the maximum measured heat flow of 2.1 Btu per (hr) (sq ft) was 57 percent less than the maximum

Table 4—Summary of Surface Temperatures, Heat Flows And Time Lags

Series	Date	Orientation	Maximum Value and Time of Occurrence						Time Lag[b] Ext. to Int. Surf., Hr
			Exterior Surf. Temp.		Heat Flow		Interior Surf. Temp.		
			F	CST	Btu/hr(sq ft)	CST	F	CST	
A-1	June 30	East	146.8	8:00 a.m.	11.50	9:12 a.m.	87.5	10:00 a.m.	2.0
		South	100.5	2:00 p.m.	4.18	1:24 a.m.	83.8	1:30 p.m.	−0.5
		West	125.0	3:00 p.m.	7.75	5:00 p.m.	84.2	5:00 p.m.	2.0
		North	100.0	2:00 p.m.	3.25	4:24 p.m.	80.7	3:00 p.m.	1.0
		Ceiling[a]	117.8	2:30 p.m.	4.07	2:00 p.m.	82.5	5:00 p.m.	2.5
A-2	August 25	East	129.0	10:00 a.m.	8.27	10:54 a.m.	84.0	10:54 a.m.	0.9
		South	135.7	11:54 a.m.	7.83	1:00 p.m.	85.1	1:00 p.m.	1.1
		West	130.7	3.00 p.m.	5.30	4:00 p.m.	82.0	4:00 p.m.	1.0
		North	101.0	11:54 a.m.	3.27	1:00 p.m.	78.8	2:00 p.m.	2.1
		Ceiling[a]	128.2	1:00 p.m.	3.54	1:00 p.m.	80.3	2:00 p.m.	1.0
B-1	August 3	East	140.5	9:06 a.m.	10.87	10:00 a.m.	86.4	10:54 a.m.	1.8
		South	130.3	12:45 p.m.	6.40	2:00 p.m.	85.2	1:18 p.m.	0.6
		West	137.2	3:54 p.m.	7.80	5:00 p.m.	85.0	4:36 p.m.	0.7
		North	103.2	1:00 p.m.	3.57	5:00 p.m.	80.7	2:00 p.m.	1.0
		Ceiling[a]	132.0	1:30 p.m.	3.97	2:00 p.m.	81.8	4:12 p.m.	2.7
B-2	August 14	East	140.8	8:54 a.m.	10.33	9:54 a.m.	85.9	11:00 a.m.	2.1
		South	129.7	12:00 noon	6.48	1:00 p.m.	84.5	1:36 p.m.	1.6
		West	131.5	3:00 p.m.	6.60	4:00 p.m.	84.0	4:00 p.m.	1.0
		North	95.2	2:00 p.m.	2.72	5:00 p.m.	79.2	3:00 p.m.	1.0
		Ceiling[a]	129.0	2:00 p.m.	3.72	2:30 p.m.	80.7	4:00 p.m.	2.0

[a]The exterior surface of the ceiling was considered to be the attic side of the insulation.
[b]Predicted time lags for all walls — 2.0 hr.
Predicted time lags for roof and ceiling — 3.0 hr.

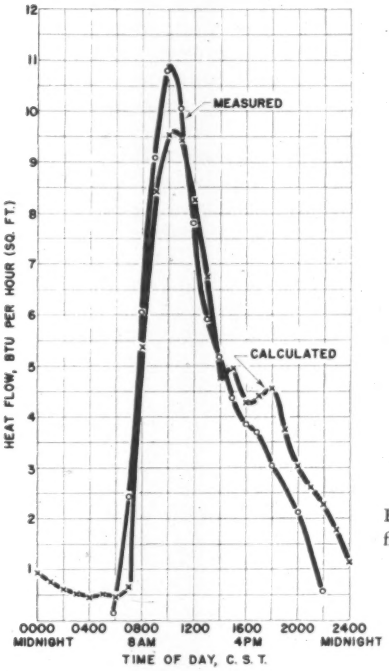

Fig. 4—Calculated and measured heat flow through east wall for August 3, 1953

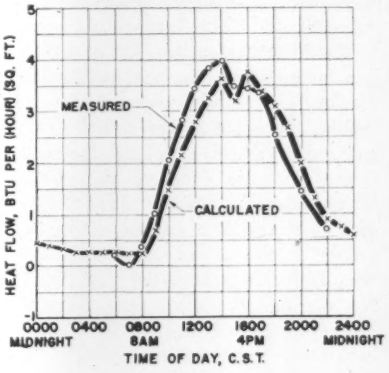

Fig. 5—Calculated and measured heat flow through ceiling for August 3, 1953

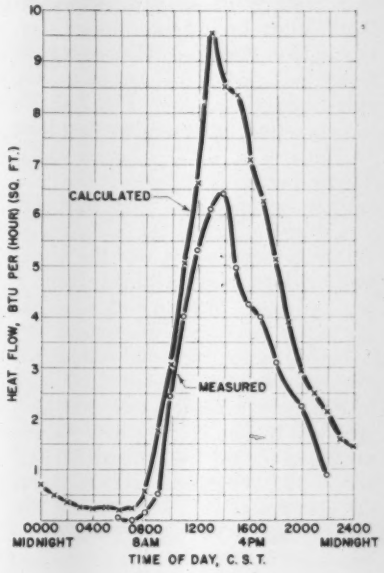

Fig. 6—Calculated and measured heat flow through south wall for August 3, 1953

calculated heat flow of 3.3 Btu per (hr) (sq ft). The marked difference in the two results was due in part to the different amounts of free ventilation in the attics of the two residences.

The measured heat flow was always less than the calculated heat flow through the south wall of the residence (see Fig. 6). The calculated heat flow was that for an unshaded south wall. It should be noted in Table 4, however, that the heat flow through the south wall increased as the season progressed. This increase in heat flow was due to the increased time of exposure of the heat-flow meter location to direct solar radiation. During the early part of the season, this heat-flow meter station was shaded completely by the 1-ft roof overhang. Near the end of the cooling season this roof overhang provided shade only during the mid-morning, and in the afternoon it was shaded by the 3-ft roof overhang on the south wall of the living room. The differences between the measured and calculated heat flows for June 30, August 3, August 14 and August 25 were 61.5, 48.8, 7.3, and 2.9 percent, respectively. If the south wall had been completely unshaded, it is doubtful if the calculated heat flow would have been greater than the measured heat flow.

Comparison of Actual and Calculated Cooling Loads

The 1952 edition of THE GUIDE was used for all cooling load calculations because the cooling load could be determined for each hour of the day by the sol-air temperature method. The wall transmission loads for the days selected for the comparison of actual and calculated cooling loads were calculated by the sol-air temperature method. The design sol-air temperatures were adjusted for the outdoor-air temperatures experienced in accordance with the correction factors given in THE GUIDE 1952. It was assumed that the indoor design conditions were maintained. Because the design sol-air temperatures did not directly apply to the combination of gable roof, vented attic, and insulated ceiling, the surface absorptivity for solar radiation on horizontal surfaces was assumed to be 0.7 rather than the value of 0.9 suggested in THE GUIDE 1952, for dark roof surfaces. This reduction in absorptivity lowered the design sol-air temperatures approximately 22 percent.

The south wall was considered to receive direct solar radiation even though a large portion of it was shaded by the roof overhang. Although it is recommended[11] that sol-air temperatures for a north wall be applied to all shaded walls, differences in the values of sky radiation and in times of peak temperatures indicated this would introduce an error. The error introduced by considering the south wall unshaded would be on the conservative side.

The heat gain through the windows was computed from tables presented in THE GUIDE 1952. A shading factor of 0.3 was applied to direct solar radiation gains for all windows equipped with awnings or shaded by the roof overhang. The heat gains through the glass by conduction and convection were corrected for the outdoor-air temperatures experienced in accordance with the recommended correction factors.

Even though outdoor design conditions were exceeded many times during the investigations, the cooling unit never operated with a capacity greater than 16,000 Btu per hr, and indoor design conditions were maintained. With a cooling

unit capacity of approximately 12,000 Btu per hr and on a design day, the indoor design conditions of 75 F dry bulb and 62.5 F wet bulb were only slightly exceeded. Fig. 7 shows the operating times and cooling load on August 3, 1953 (Series B-1). As mentioned previously, the calculated cooling load for this day was adjusted for the outdoor-air temperatures experienced, and the actual cooling load was obtained from a heat balance. Similar data were obtained for the other three series.

In all cases, the total calculated heat gain for the period 6:00 a.m. to midnight exceeded the total heat removed by the cooling unit during the same period by at least 57 percent. For Series B-1 tests the total calculated heat gain was 220,880 Btu during the 18-hr period, while the measured heat removed was 140,300 Btu. This was a difference of 57.4 percent based on the measured value. For the three other series, A-1, A-2, and B-2, the differences in total heat gain based on the measured value were 84.9, 104.0 and 107.0 percent, respectively. The large differences in the latter two series (A-2 and B-2) can be attributed in part to the low outdoor-air temperatures experienced during the night hours and the consequent flywheel effect of the residence and the concrete slab floor. The differences for the three series, A-1, A-2, and B-2, can be attributed partly to deviations of actual solar conditions from those used as a basis for the design sol-air temperatures.

The calculated and actual cooling loads for nine 2-hr periods on June 30 (Series A-1) and on August 3 (Series B-1) are shown in Table 5. The values were determined by integrating the areas under the curves of measured and calculated cooling loads. The data in Table 5 show the typical trends for the two methods of blower operation investigated. The differences between the measured and calculated cooling loads are large for most of the 2-hr periods during the day. During the period of the first compressor operations of the day, a small difference in the loads for Series A-1 (blower operated continuously) was observed as compared with a large difference observed for Series B-1 (blower cycled with compressor). Near the end of the compressor operations for the day, a large difference between the measured and calculated cooling loads was observed for Series A-1 as compared to a small difference observed for Series B-1. The large differences between the measured and calculated cooling loads which occurred at the beginning and end of daily compressor operation for the two series resulted from the type of blower operation used.

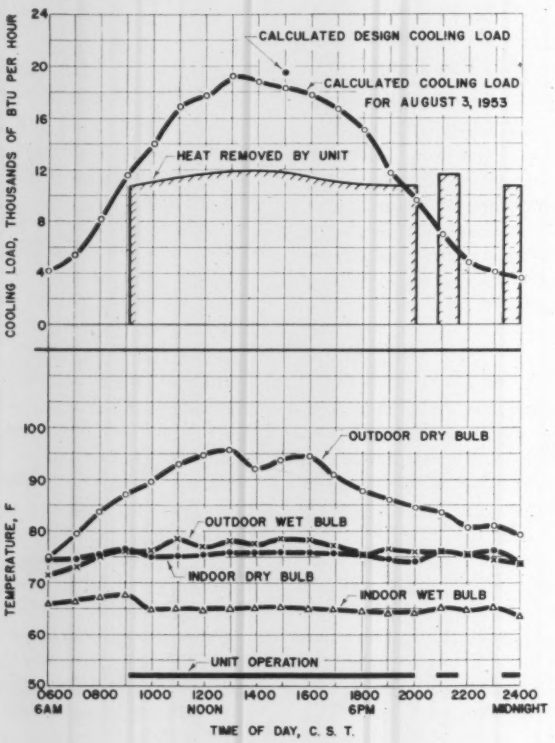

Fig. 7—Actual and calculated cooling loads of residence for August 3, 1953 (Series B-1)

When the blower operated continuously, Series A-1, the circulating air reduced the night-time flywheel effect of the slab floor. In the day time, the internal energy of the concrete slab decreased during the operation of the compressor. When the compressor ceased to operate, the circulating air increased the internal energy of the slab until an isothermal condition was approached in the residence. The heat gains that occurred during the late evening hours were absorbed by the slab in this manner, and therefore did not cause further compressor operation. Since the cooling unit did not have to operate to maintain the control temperature within the residence, a large difference in measured and calculated cooling loads resulted. The heat gains which occurred in the morning were not absorbed by the slab because of the small temperature differences between the slab and the room air and surrounding surfaces. Since these heat gains were not absorbed by the slab, they raised the room-air temperature above the control point, causing the compressor to operate. When the air temperature within the residence responded directly to the heat gains, the difference in actual and calculated cooling loads was small.

When the blower cycled with the compressor, the internal energy of the concrete slab floor was raised only slightly during the late evening hours. For this reason, the heat gains raised the room-air tempera-

tures causing the compressor to operate. The response of the room-air temperature to the heat gains caused the small differences observed in the actual and calculated cooling loads. With the blower cycling with the compressor, the internal energy of the concrete slab was not raised appreciably during the night; hence, lower floor-surface temperatures were observed in the morning. Due to the temperature differences between the slab and its surroundings when the heat gains began to increase in the morning, the slab absorbed these gains causing the apparently large difference between the measured and calculated cooling loads.

Although a concrete slab floor will act as a thermal flywheel, the effect of the slab on the actual cooling load is not known. The preceding discussion should not be interpreted as a statement of percentage effects that a concrete slab floor will have on the cooling load of a small residence. Rather, it serves to point out that a slab will have some leveling effect on the cooling load in that it will minimize the cyclic variation of the heat gain. Hence, a smaller cooling unit will be able to provide comfortable conditions in a residence with a concrete slab floor than that predicted by the usual methods of calculating the cooling load.

Floor-Surface Temperatures and Room-Air Dew Points

Floor-surface temperatures in the vicinities of the subfloor plenum, the feeder ducts, and the perimeter loop were found to vary with the length of compressor operation during the day. These temperatures decreased as the compressor operation time increased. When the cooling unit ceased operation late in the day, a marked increase of these floor surface temperatures was observed. This cyclic phenomenon was more noticeable in Series A-1 and A-2 than in Series B-1 and B-2, since the floor slab was cooled by the conditioned air when the compressor was on and heated by the recirculated room air when the compressor was off. In both series in which the blower cycled with the compressor (B-1 and B-2), when the compressor was off, the air in the embedded ducts absorbed heat from its immediate surroundings and finally reached a thermal equilibrium so that a fairly constant temperature was maintained until the next compressor operation.

The minimum floor-surface temperatures were found near the subfloor plenum. Floor-surface temperatures in areas remote from the ducts and the subfloor plenum were found to equal or exceed the room-air temperature. This was attributed to diffuse radiation from the walls and the ceiling to the cooler floor surface. Floor-surface temperatures directly over the feeder ducts were found to be uniform from the pit to the loop. This was attributed to the upward slope of the feeder ducts from the pit to their junctions with the loop duct.

The room-air dew-point temperatures experienced in Series A-1 and A-2 were higher than those experienced in Series B-1 and B-2. When the blower operated continuously, water which had been condensed but not drained out of the evaporator coils during compressor operation was re-evaporated. The amount of re-evaporation was calculated by two methods for July 18 (Series A-1) after the cooling unit had operated continuously for 8 hr and 25 min. In one case the amount of re-evaporated moisture was determined by the conditions of the air entering and leaving the cooling unit. In the second method, room-air conditions served as the basis of calculation.

After the compressor was off for 1.67 hr, the amount of re-evaporated moisture as calculated by the first method was 2.24 lb, while a value of 1.69 lb was determined by the second method. The difference of 0.55 lb of water can be considered to be absorbed by the house and furnishings. Within the same period, the room-air dew point increased from 58.2 to 67.0 F.

During the testing period, from June 24 to August 31, there was no visible evidence of condensation on the floor surface. The daily maximum room-air dew point and the minimum floor-surface temperature at that same time were evaluated and are shown in Fig. 8. The fact that the maximum room-air dew point was always lower than the minimum floor-surface temperature further substantiated that condensation on the floor could not have occurred.

Table 5—Comparison of Measured and Calculated Heat Removal by Unit

Period	Series A-1, June 30, 1953			Series B-1, August 3, 1953		
	Measured	Calculated	Percent Difference Based on Measured	Measured	Calculated	Percent Difference Based on Measured
6:00 — 8:00 a.m.	0	14,100	—	0	11,200	—
8:00 — 10:00 a.m.	14,100	26,000	84.4	10,100	22,400	122.0
10:00 — 12:00 noon	22,700	33,900	49.3	22,400	32,800	46.4
12:00 — 2:00 p.m.	21,500	37,900	76.2	23,900	37,200	55.6
2:00 — 4:00 p.m.	20,900	38,200	82.7	23,900	36,500	52.7
4:00 — 6:00 p.m.	21,500	35,200	64.7	22,400	34,000	51.8
6:00 — 8:00 p.m.	21,400	26,500	23.8	21,600	24,300	12.5
8:00 — 10:00 p.m.	6,560	16,100	144.0	9,280	14,400	55.2
10:00 — 12:00 mid.	0	9,760	—	6,720	8,080	20.2
Totals	128,660	237,660	+84.9	140,300	220,880	57.4

Operating Characteristics

The air distribution in the living room was investigated during one long cycle of the cooling unit. When the unit was operating at the higher capacity and consequently on short running cycles, an isothermal condition in the living zone was approached during each off cycle. Since this would tend to eliminate any stratification or drafts caused by the delivery of conditioned air from floor registers, the long operation was considered to be the worst condition which would be encountered.

During the air distribution study, room-air temperatures and velocities were taken at four levels in the living room. At no point in the living zone did the room-air velocity exceed 32 fpm except immediately above the supply outlets. At the floor level, where the lowest room-air temperatures were experienced, the room-air velocities did not exceed

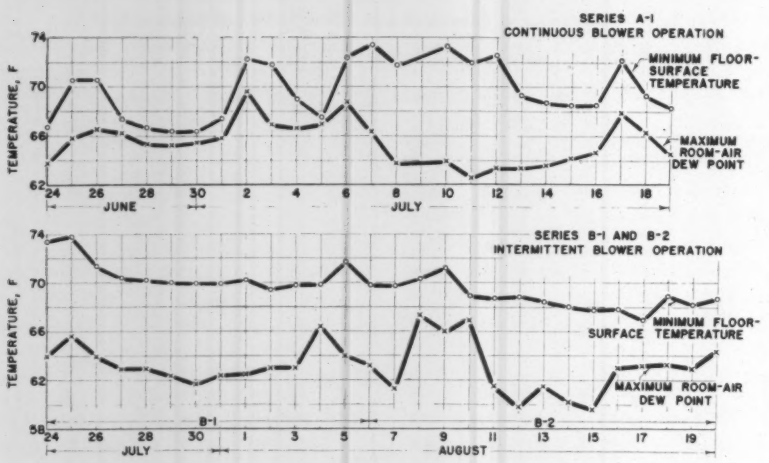

Fig. 8—Daily maximum room-air dew point and minimum floor-surface temperature

15 fpm. This low velocity was considered desirable because of the low air temperatures in this region. During the study the maximum observed temperature difference from the floor level to the ceiling level was 2.7 deg. That the air distribution experienced when floor registers were used was acceptable for cooling was shown by this study and by the temperature conditions maintained in the residence throughout the cooling season.

The temperature variations at the 30-in. level observed in Series A-1 and B-1 were small. Due to the low capacity of the cooling unit in these two series, it usually operated continuously for a long period, thus keeping the room-air temperatures at fairly constant values. The difference between the maximum room-air temperature which occurred just prior to the compressor operation and the minimum room-air temperature which occurred at the end of long compressor operation was found to be less than 2 deg. This slight variation of room-air temperature is shown in Fig. 7. When the cooling unit was operating at the higher capacity (Series A-2 and B-2), frequent and short cycles were experienced. Due to this condition, the room-air temperature varied in a cyclic form about in step with the unit operation. The maximum variation was found to be 2.5 deg.

The room-air temperature balance was found to depend on the time of day and the type of operation. For instance, in the south bedroom, which was exposed on the east and south, higher room-air temperatures were experienced than in the rest of the rooms in the late morning just prior to the unit operation. A difference of 2 to 3 deg was found for Series A-1 and A-2, and a difference of 1 to 2 deg was found for Series B-1 and B-2 at that time of the day. The smaller difference in room-air temperatures between rooms experienced in Series B-1 and B-2 (blower cycled with compressor) was attributed to the cooling effect of the floor slab.

The room-to-room temperature balance at 3:00 p.m. CST for all four test series was found to be:

1. Series A-1: 0.5 to 1.8 deg
2. Series A-2: 1.0 to 1.8 deg
3. Series B-1: 0.4 to 1.4 deg
4. Series B-2: 0.6 to 1.4 deg

In both Series A-1 and B-1, maximum differences for most temperature measuring stations were less than 1.0 deg. This small room-to-room temperature difference was attributed to the low capacity of the unit and long unit operation in these series.

The cooling unit was operated at two refrigeration capacities during the studies. The lowest, which was observed when the installation of the cooling unit had been completed, was approximately 12,000 Btu per hr, half of its rated capacity. Two series of studies, A-1 and B-1, were made with the unit operating at this capacity. The capacity of the unit was raised to 16,000 Btu per hr for Series A-2 and B-2. The latter condition was still much below the rated capacity of the unit; however, this discrepancy was attributed to the differences between the rating conditions and those under which these studies were conducted. The high water consumption observed in Series A-1 was caused by an overcharge of refrigerant in the cooling unit. This overcharge, which caused the large water flow rate through the condenser, had no appreciable effect on the capacity of the cooling unit.

A summary of cooling unit operating characteristics is presented in Table 6. The compressor operated a total of 374 hr during the four test series. The total power and water consumptions of the unit were 742 kw hr and 5,568 cu ft, respectively. The blower power consumption was fairly constant in all series with an average value of 0.15 kw. The total blower power consumption for the four series was 158 kw hr. If the blower had been operated continuously during the four studies, it would have consumed 232 kw hr. The blower would have used only 57 kw hr if it had been cycled with the compressor during the four series. Hence, a saving of 175 kw hr would have resulted if the blower had cycled with the compressor during the entire investigation.

The measured pressure losses in the air distribution system for an airflow rate of 600 cfm were 0.094 in. of water on the supply-air side of the system and 0.011 on the return-air side. This is a total of 0.105 in. of water for the system. For an airflow rate of 430 cfm, a total pressure loss of 0.130 in. of water was found with the same duct system during heating investigations conducted[12] in Research Residence No. 3. The difference in pressure losses experienced with heating and cooling was due to the increases in size of the return-air grille and duct and in the adjustment of the registers to obtain the most satisfactory room-to-room temperature balance when cooling the residence.

Conclusions

The time lag of the heat flow through the east wall of the residence varied only slightly during the studies, but the time lags for the other walls and the ceiling showed considerable variation. Average time lags determined from data for *design days* for the east, south, west and north walls were 1.7, 1.4, 1.2 and 1.3 hr, respectively. The average time lag for the ceiling was 2.1 hr for these days. The average time lag in heat flow through the west wall determined from recorded data for 27 days was approximately 1.1 hr.

In general, the measured heat-flow rates through walls exposed to direct solar radiation were higher than the calculated rates. The measured heat-flow rates through walls not exposed to direct solar radiation were less than the calculated rates. The 22 percent reduction in the sol-air temperatures for horizontal surfaces applied to the roof-attic-ceiling combination caused the measured heat-flow rate to be greater than the calculated rate. The difference between the measured and calculated heat-flow rates through the south wall decreased as the season progressed due to the increased time the heat-flow meter location was exposed to direct solar radiation. The calculated heat-flow rates were based on the sol-air temperatures for an unshaded south wall.

On a day when outdoor design conditions were exceeded, a room-air temperature rise of less than 1.5 F above control temperature was experienced even though the cooling unit was operating at half its rated capacity. In all studies, the total calculated heat gain for the period 6:00 a.m. to midnight exceeded the total heat removed by the cooling unit during the same period by at least 57 percent. When the blower operated continuously, the largest differences between the measured and calculated cooling loads occurred near the end of compressor operation. With the blower cycled with the compressor, the largest differences in measured and calculated cooling loads occurred at the beginning of the compressor operation. The variance in times of occurrence of the large differences was attributed to the flywheel effect of the concrete slab floor.

During the testing period, June 24 to August 31, there was no visible evidence of condensation on the floor surface. Since the maximum room-air dew-point temperature was lower than the corresponding minimum floor-surface temperature at any time, condensation on the floor surface could not have occurred.

Table 6—Summary of Unit Operation Characteristics

Series	Date	Maximum for One Series: Hours Operation	Maximum for One Series: Compressor Power, kwhr	Maximum for One Series: Water Consumption cu ft	Period	Total for Series: Hours Operation	Total for Series: Power Consumption, kwhr: Comp.	Total for Series: Power Consumption, kwhr: Blower	Total for Series: Water Consumption cu ft
A-1	June 30	11.85	23.6	258.2[a]	June 24—July 19	170.57	347.7	94.3	2903.1[a]
A-2	August 31	8.30	17.2	148.6	August 21—August 31	55.88	97.1	40.4	1013.5
B-1	August 1	13.07	27.2	111.3	July 25—August 6	118.60	239.6	18.6	1093.6
B-2	August 14	4.63	9.5	89.8	August 7—August 20	28.52	58.0	4.6	558.1

[a]High water consumption due to an overcharge of refrigerant.

Acknowledgments

This paper reports one phase of a comprehensive investigation conducted in Warm Air Heating Research Residence No. 3 under the terms of a cooperative agreement between the *National Warm Air Heating and Air Conditioning Association* and the Engineering Experiment Station of the University of Illinois. These results will ultimately comprise part of a bulletin of the Engineering Experiment Station.

Acknowledgment is made to the manufacturers who cooperated by furnishing equipment used in the investigation.

References

1. Study of Summer Cooling in the Research Residence at the University of Illinois, by A. P. Kratz and S. Konzo (ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, February 1933).

2. Study of Summer Cooling in the Research Residence for the Summer of 1933, by A. P. Kratz and S. Konzo (ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, December 1933).

3. Study of Unit Room Coolers in the Research Residence, by A. P. Kratz, M. K. Fahnestock and S. Konzo (ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, November 1934).

4. Study of Summer Cooling in the Research Residence for the Summer of 1934, by A. P. Kratz, S. Konzo, M. K. Fahnestock, and E. L. Broderick (ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, January 1935).

5. Study of Summer Cooling in the Research Residence Using Water from the City Mains, by A. P. Kratz, M. K. Fahnestock, S. Konzo, and E. L. Broderick (ASHVE JOURNAL SECTION, *Heating, Pip-& Air Conditioning*, May 1936).

6. Study of Summer Cooling in the Research Residence Using Water at Temperatures of 52 F and 46 F, by A. P. Kratz, S. Konzo and E. L. Broderick (ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, June 1937).

7. Study of Summer Cooling in the Research Residence Using a Small Capacity Mechanical Condensing Unit, by A. P. Kratz, M. K. Fahnestock, S. Konzo and E. L. Broderick (ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, May and June 1938).

8. Study of Summer Cooling in the Research Residence for the Summer of 1938, by A. P. Kratz, S. Konzo, M. K. Fahnestock and E. L. Broderick (ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, August 1939).

9. Summer Cooling in the Research Residence with a Gas-Fired Dehydration Cooling Unit, by A. P. Kratz, S. Konzo and E. L. Broderick (ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, December 1940).

10. Cooling A Small Residence With A Two-Horsepower Mechanical Condensing Unit, by H. T. Gilkey, D. R. Bahnfleth and R. W. Roose (ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, February 1953).

11. HEATING, VENTILATING, AIR CONDITIONING GUIDE (published by THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, New York, N. Y.).

12. Performance of Warm-Air Perimeter-Loop and Perimeter-Radial Systems in a Residence, by H. T. Gilkey, R. W. Roose and M. E. Childs (ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, October 1953).

13. *Manual 4*, Warm Air Perimeter Heating, *National Warm Air Heating and Air Conditioning Association*, 2nd edn., 1951.

JOURNAL SECTION

Design and Economics of Solar Energy Heat Pump Systems†

By R. C. Jordan* and J. L. Threlkeld**, Minneapolis, Minn.

This paper is the result of research sponsored by THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS in cooperation with the Department of Mechanical Engineering of the University of Minnesota

SUMMARY — This is the last of a series of three articles dealing with solar energy as a heat source for the heat pump. This article involves architectural considerations, component requirements, operating costs, and general feasibility of solar energy heat pump systems. Four designs of solar houses are presented. Collector, heat storage, heat pump, and auxiliary heating requirements are calculated for four localities. Operating cost analyses are given comparing electricity costs for the heat pump with fuel costs for natural gas and oil-fired systems. The demand for heating and cooling in the United States is discussed and a map showing relative feasibility of solar energy heat pump systems is presented.

A HOUSE designed for utilizing solar energy for heating purposes presents many specialized problems. A large south-facing vertical collector is required for most sections of the country except, perhaps, in the most southerly latitudes, where a south-facing tilted collector is advantageous. In either case, a non-conventional type of construction is dictated. It is desirable to have the collector an integral part of the house structure in regard to construction costs, but separation of the collector from the house causes only a slight reduction in collector efficiency if the rear of the collector is properly insulated and the temperature difference between the collector plate and the outdoor air is moderate.

The design of a solar heated house offers formidable problems to the architect. A large lot is necessary to accommodate a house of such a long, narrow nature; sufficient space in front of the collector is required to prevent shading from neighboring buildings and to prevent reflection from the collector from disturbing inhabitants of nearby buildings. In northerly regions the collector area required may be so large that it dominates the exterior of the house and also complicates the admission of sunlight to the interior. If the collector is to be kept to a moderate horizontal dimension it must be high, or else the vertical dimension may be reduced by allowing the collector to extend beyond the house for some distance. When a south-facing hillside lot is available, a two-level design may be adopted. The upper level may open to the north and the lower level to the south. This scheme offers the possibility of lessening the apparent height of the collector by contrasting it with the hill itself. A house designed for southerly areas is not as great a problem since far less collector area is required. Regardless of the geographical location, any design must be a compromise between a well-engineered solar utilization system and a house whose livable qualities can compete with more conventional types of architecture.

Figs. 1, 3, 4, and 5‡ show four different architectural designs of solar houses with flat-plate type, south-facing collectors, and Fig. 2 shows the floor plan of the house of Fig. 1. The design of the house shown in Fig. 1, with the extension of the south-facing vertical collector to form one side of a court, permits full south fenestration of the living room and adequate fenestration on all sides. A full basement is provided for laundry, mechanical equipment, and heat storage facilities. Fig. 3 shows a two-level house using a vertical collector for a south-facing hillside location. The upper level contains the living quarters and the lower level includes a garage and laundry, mechanical equipment, and heat storage facilities. This design results in a collector of large height and consequent shorter length. The designs of Figs. 4 and 5 employ tilted collectors and are primarily for southerly regions of the United States. The design of Fig. 4 is for two levels with bedrooms on the second level and living room and kitchen on the first level. The south side of the lower level has full fenestration. Utility spaces are provided in a basement. The design of Fig. 5 is for three levels with kitchen and dining room on the upper level,

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‡These sketches and plans were prepared under the direction of Prof. Harlan McClure of the University of Minnesota School of Architecture.

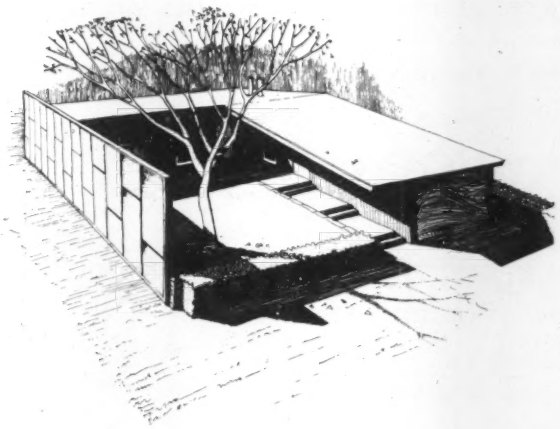
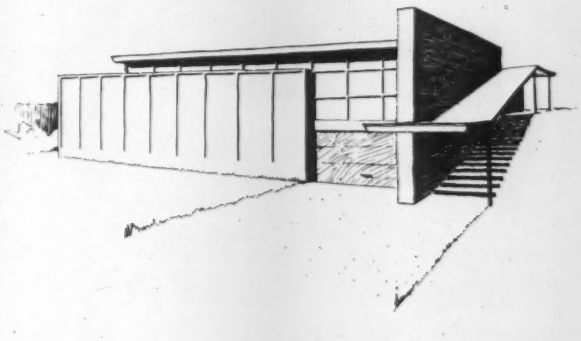


Fig. 1—Solar house with south-facing vertical collector

Fig. 3—Solar house with south-facing vertical collector for hillside location



living room and entry on an intermediate level, and bedrooms on the lower level.

System Requirements

Calculation of Collector Area Required. The house shown in Figs. 1 and 2 was used as the example for the calculations. Complete working drawings were available so that heat loss calculations could be made. Insulation was 4 in. of rock wool above the ceiling and 2 in. of blanket insulation in the outside walls. The design heating load was calculated in accordance with Chapter 12 of the HEATING, VENTILATING, AIR CONDITIONING GUIDE 1953, with infiltration estimated by the crackage method. Table 1 shows the design heat loss and the January average heat loss for Madison, Wis.; Lincoln, Neb.; Nashville, Tenn., and New Orleans, La.

The January average heat loss was calculated by the equation

$$q_{av} = q_d\ (70 - t_{o,av})/(70 - t_o) \quad ..(1)$$

The temperature difference $(70 - t_{o,av})$ was used as an approximation in Equation 1 rather than the usual $(65 - t_{o,av})$ because separate credit for solar gains through the window glass was allowed in later calculations.

The collector area is found by a simple energy balance between the total energy which may be collected on an average January day and the January average daily heat loss. Thus

$$A_c = (Q_{av} - Q_{g,av})/Q_{s,av}\ \eta_d R \quad .....(2)$$

Table 2 shows the results of calculations for required collector area for Madison, Lincoln, Nashville and New Orleans. The January average daily radiation incident upon a south-facing vertical surface ($Q_{s,av}$) was taken from Weather Bureau data. The collector efficiency η_d shown is based upon a collector plate temperature of 60 F and the January average outdoor air temperature. Two glass panes are assumed for Madison and Lincoln and one glass pane for Nashville and New Orleans. The collector efficiencies and the value of $R = 1.28$ were taken from curves presented in a previous article[1]. The value of R was based upon a condensing temperature of 115 F and an evaporating temperature of 50 F. Rational equations were developed for estimating the solar heat gain

Table 1—Calculated Heat Losses for House of Fig. 1

City	t_o F	$t_{o,av}$ F	q_d Btu per hr	q_{av} Btu per hr
Madison	−15	18	65,000	40,000
Lincoln	−10	25	62,000	35,000
Nashville	0	40	53,000	23,000
New Orleans	20	55	35,000	10,500

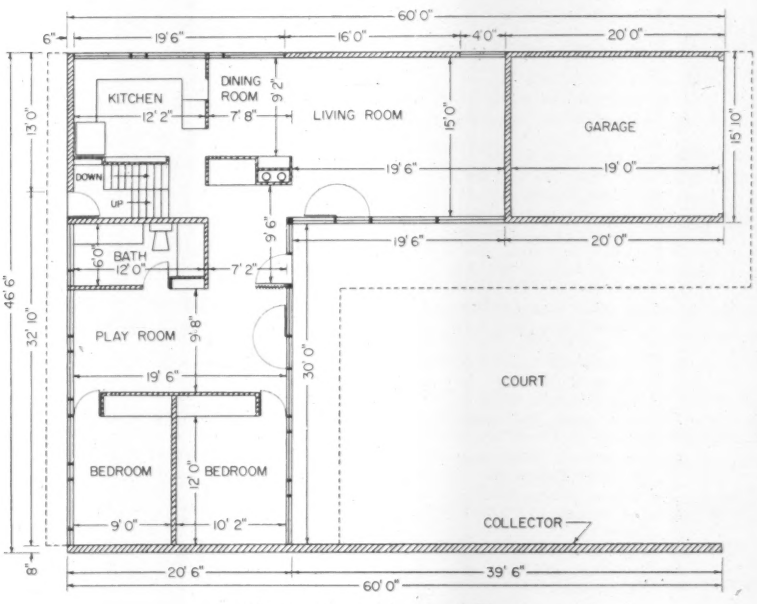
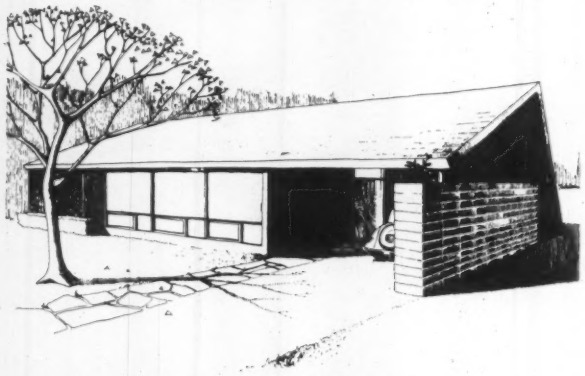


Fig. 2—Plan of house of Fig. 1

[1]Exponent numerals refer to References.

Fig. 4—Two-level solar house with south-facing tilted collector

Fig. 5—Three level solar house with south-facing tilted collector



through the windows at any time of day. Integration of the equations gave values of $Q_{g,av}$.

Table 2 shows that a small collector of 226 sq ft is required for New Orleans, a collector with 715 sq ft of surface is required for Lincoln, and relatively large collectors of 1010 and 1210 sq ft of surface respectively are required for Nashville and Madison. The collector shown in Fig. 1 has a gross surface area of 720 sq ft, or approximately suitable for Lincoln.

No suitable correlation exists between collector area and house floor area, or between collector area and house volume, since these ratios vary greatly with architectural design.

As a matter of interest, these ratios are presented in Table 3 for the example house.

Estimation of Heat Storage Required. In order to estimate the extent of heat storage capacity required, it is necessary to make a study of Weather Bureau records to determine sequence of days below-threshold and below-average incident radiation. Such a study was made for the four localities and has been discussed in a previous article.[2] From these data, it is possible to estimate the number of days of heat storage needed for the example house of Fig. 1. The approximation used was to consider a day having less than threshold radiation as a full day of heat storage and a day with less than average radiation as one-half day of heat storage.

Table 2 — Summary of Calculations for Collector Area

City	Q_{av} Btu per day	$Q_{g,av}$ Btu per day	$Q_{s,av}$ Btu per (day) (sq ft)	η_d	A_c sq ft
Madison	960,000	79,900	960	0.59	1210
Lincoln	840,000	92,600	1220	0.67	715
Nashville	550,000	40,400	570	0.69	1010
New Orleans	250,000	54,800	810	0.83	226

Table 4 shows the estimated number of average January days of heat storage needed for the four cities and it can be seen that the storage requirements vary widely from year to year with the maximum generally much higher than the average. The

Nomenclature

A_c = surface area of collector, square feet.
q_{av} = January average rate of heat loss, Btu per hour.
q_d = design rate of heat loss, Btu per hour.
Q_{av} = January average rate of heat loss, Btu per day.
$Q_{g,av}$ = January average rate of solar heat gain through window glass, Btu per day.
$Q_{s,av}$ = January average rate of radiation incident upon a southfacing vertical surface, Btu per day, per square foot.
R = ratio of heat rejected in condenser to heat absorbed in evaporator of heat pump, dimensionless.
t_o = outdoor air design temperature, Fahrenheit.
$t_{o,av}$ = January average outdoor air temperature, Fahrenheit.
η_d = January average daily collector efficiency, dimensionless.

Table 3 — Ratio of Collector Area to Floor Area and to House Volume for House of Fig. 1

City	Ratio of collector area to house floor area	Ratio of collector area to house volume
Madison	1.0	0.13
Lincoln	0.59	0.074
Nashville	0.83	0.104
New Orleans	0.19	0.023

Table 4—Estimated Number of Average Days of Heat Storage Required

Season	Madison		Lincoln		Nashville		New Orleans	
	Dec.	Jan.	Dec.	Jan.	Dec.	Jan.	Dec.	Jan.
1951-1952	3	3		[a]		4		
1950-1951	3	4	[a]	[a]	2	3		
1949-1950	5	3	2	[a]	3	9		
1948-1949	2	4	2	3	5	8		
1947-1948	[a]	6	[a]	[a]	[a]	[a]		
1946-1947	[a]	2	3	[a]	[a]	10		
1945-1946	4	2	2	[a]	6	6	[a]	4
1944-1945	2	6	2	7	12	11		
1943-1944	[a]	3	[a]	3	10	4	5	
1942-1943	4	7	5	6	9	[a]	3	
1941-1942	7	4	4	4			3	[a]
1940-1941	9		9	10			2	2
1939-1940	2	[a]	2	[a]			[a]	5
1938-1939	8	6	[a]	[a]			[a]	[a]
1937-1938	7	8	2	5			3	[a]
1936-1937	6	2	2	3				8
1935-1936	4	6	4	6			[a]	4
1934-1935	5	4	[a]	[a]			[a]	3
1933-1934	2	8	[a]	6			4	5
1932-1933	[a]	3	[a]	[a]			10	10
1931-1932	9	17	6	5				6
Days of Storage Selected		8		7		11		8

[a]Data available, but only overnight storage indicated. Blank places indicate no data available.

Table 5—Estimated Heat Storage Requirement for House of Fig. 1

City	Million Btu	Volume cu ft[a]	
		Condenser Side	Evaporator Side
Madison	7.68	768	600
Lincoln	5.88	588	460
Nashville	6.05	605	470
New Orleans	2.00	200	156

[a]Based on heat capacity of 10,000 Btu per cu ft.

Table 6—Heat Pump Requirements for House of Fig. 1 for a Dichlorodifluoromethane (F-12) System Using Condenser-side Heat Storage and Single-stage Heat Pump

City	Energy Available to Heat Pump		Evap Capacity Tons	Cond Capacity Btu per hr	Piston Displacement cfm	Brake Horsepower
	Btu per (hr) (sq ft)	Btu per hr				
Madison	217	262,000	21.8	335,000	71	21.8
Lincoln	217	155,000	12.9	198,000	42	12.9
Nashville	236	238,000	19.8	305,000	65	19.8
New Orleans	236	53,000	4.4	68,000	15	4.4

number of days of heat storage to be allowed is a matter of judgment. According to Table 4, Madison may need up to 17 days, but there is no assurance that there may not be years which will require more. An average year at Madison requires heat storage for only eight days, and it would be uneconomical to attempt to provide a quantity of heat storage sufficient for any circumstance. An auxiliary heating system must be provided regardless, and therefore the logical solution appears to be to provide storage capacity sufficient for most years and to rely on auxiliary heating for those few unfavorable years when more storage capacity is needed. The number of days of heat storage selected are shown at the bottom of Table 4.

The volume of heat storage medium required for either the condenser side or evaporator side of the heat pump may be estimated if suitable mediums with known heat capacities are available. As discussed in a previous article,[1] several suitable materials are available for condenser-side storage but practically none for evaporator-side storage. There is, however, the definite possibility that such materials may be synthetically compounded. For example such a compound as diethyl isophthalate is probably non-corrosive and non-toxic and has a freezing point of approximately 50 F. However, its latent heat of fusion is too low for satisfactory heat storage use. In the present analysis a hypothetical heat of fusion type storage medium has been chosen for the condenser-side and the evaporator-side of the heat pump, each with a heat capacity of 10,000 Btu per cu ft and a suitable melting temperature.

Table 5 shows the estimated volume of storage medium for the four localities. The storage requirement in Btu was found by multiplying the number of January days of storage selected in Table 4 by the January average heat loss in Btu per day from Table 2. The evaporator-side volume was found by dividing the condenser-side volume by $R = 1.28$. It is significant that the storage volumes shown in Table 5 are not unreasonably large and that the largest volume shown is approximately equivalent to a room 10 ft $\times$ 10 ft $\times$ 8 ft high.

Estimation of Heat Pump Requirements. Before the performance requirements of the heat pump may be determined it is necessary to establish the type of heat pump system to be used. In a previous article,[3] it was shown that the single-stage vapor compression system is desirable for the case of constant temperatures of heat source and heat sink, and that the multiple-step condensation system is desirable if the sink temperature is variable.

Fig. 6 shows a schematic year-around air conditioning system using condenser-side storage and a single-stage heat pump. Fig. 7 shows a schematic system using evaporator-side storage and a two-step condensation heat pump. In both systems air is used as the transport medium and the duct dampers are set for winter operation. No auxiliary heat supply is shown but it could be placed on either side of the heat pump, preferably in the storage chamber.

All analyses of this section are premised upon the assumption that the solar energy-heat pump system is capable of utilizing all radiation which can be collected during an average month of January. Thus, a system equipped with condenser-side storage must have a heat pump with a capacity sufficiently large to handle the surplus solar energy available during clear, relatively warm January days. An hourly rate of radiation incident upon a south-facing vertical surface of 275 Btu per (hr) (sq ft) is typical of mid-day radiation during a cloudless January day in most parts of the country. If the day is relatively warm, the collector efficiency approaches the transmissivity — absorptivity product $(\tau\alpha)_t$ of the glass panes and collector plate.

Table 6 shows the heat pump requirements for a system employing condenser-side storage and a single-stage heat pump (Fig. 6). The results are based upon an hourly rate of incident radiation of 275 Btu per (sq ft), $(\tau\alpha)_t$ equal to 0.79 for Madison and Lincoln and 0.86 for Nashville and New Orleans, a condensing

Table 7—Heat Pump Requirements for House of Fig. 1 for a Dichlorodifluoromethane (F-12) System Using Evaporator-side Heat Storage and Single-stage Heat Pump

City	Cond Capacity Btu per hr	Evap Capacity Tons	Piston Displacement cfm	Brake Horsepower
Madison	65,000	4.2	15	4.2
Lincoln	62,000	4.0	14	4.0
Nashville	53,000	3.4	12	3.4
New Orleans	35,000	2.3	8	2.3

Table 8—Heat Pump Requirements for House of Fig. 1 for a dichlorodifluoromethane (F-12) System Using Evaporator-side Heat Storage and Two-step Condensation Heat Pump[a]

City	Condenser Capacity Btu per hr		Evap Capacity Tons	Piston Displacement cfm		Brake Horsepower	
	Cond 1	Cond 2		Comp 1	Comp 2	Comp 1	Comp 2
Madison	32,500	32,500	4.4	8.0	6.0	2.4	1.2
Lincoln	31,000	31,000	4.2	7.7	5.7	2.3	1.2
Nashville	26,500	26,500	3.6	6.3	5.1	1.9	1.1
New Orleans	17,500	17,500	2.4	4.3	3.3	1.3	0.7

[a]Condenser 1 and Compressor 1 operate at higher condensing temperature; Condenser 2 and Compressor 2 operate at lower condensing temperature.

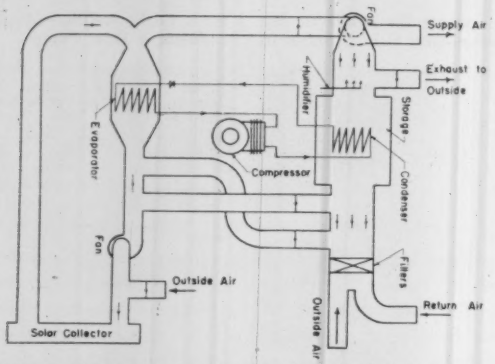


Fig. 6—Schematic year 'round air conditioning system using condenser-side heat storage and single-storage heat pump

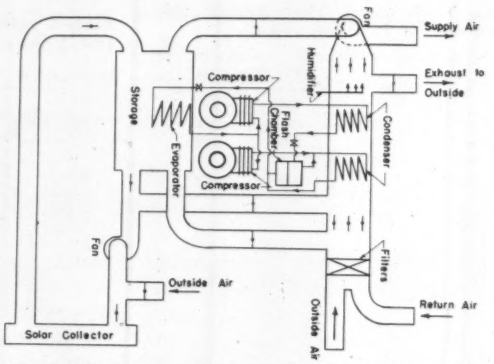


Fig. 7—Schematic year 'round air conditioning system using evaporator-side heat storage and two-step condensation heat pump

temperature of 115 F, and an evaporating temperature of 50 F. The compressor piston displacement and horsepower were found from a typical manufacturer's rating tables.

In a system equipped with evaporator-side storage, the heat pump must have a condenser capacity equal to the design heating load. Table 7 shows heat pump requirements for a system using evaporator-side storage and a single-stage heat pump. Operating conditions are 115 F condensing temperature and 50 F evaporating temperature.

Table 8 shows heat pump requirements for a system using evaporator-side heat storage and two-step condensation heat pump (Fig. 7). Operating conditions are 115 F upper condensing temperature, 90 F lower condensing temperature, and 50 F evaporating temperature. Although the ratio R of heat rejected in the condenser to heat absorbed in the evaporator is closely equal to that of the single-stage system, a more accurate value of $R = 1.23$ was used instead of 1.28 used in the calculations for Tables 6 and 7. Again, the compressor displacement and horsepower were taken from manufacturer's rating tables.

Table 9—Estimated Auxiliary Heating System Capacity in Btu per hour for House of Fig. 1.

City	Condenser Side	Evaporator Side
Madison	40,000	31,000
Lincoln	35,000	27,000
Nashville	23,000	18,000
New Orleans	10,500	8,200

Comparison of Table 6 with Tables 7 and 8 shows that a system using condenser-side storage requires equipment about five times larger than a system using evaporator-side storage. Comparison of Table 7 with Table 8 shows that a two-step condensation heat pump requires somewhat smaller displacement and horsepower than a single-stage heat pump.

It appears without question that evaporator-side storage is preferable, and a two-step condensation heat pump is preferable to a single-stage system. Slightly smaller displacement and power capacity are required and a higher coefficient of performance may be realized.

Estimation of Auxiliary Heat Required. The calculation of collector area presented previously was based upon an assumed incident radiation equal to the long-time January average. However, average daily radiation in January varies widely from year to year, and negative deviations from the long-time average of 30 percent or more may be expected. In addition, the estimation of heat storage required was based upon a sufficient quantity for most years but not enough for the worst years on record. For both these reasons auxiliary heating will be required. The auxiliary heating system must have sufficient capacity to provide the entire heat source for several consecutive days. Usually such periods are days with above average temperature. It appears that a capacity equal to the average January heat loss in Btu per hour is adequate. Table 9 shows auxiliary heating system capacities for both the condenser-side and evaporator-side of the heat pump. It is desirable to supply the auxiliary heat to the storage medium.

Cost Analysis

The first cost of a conventional heat pump system is comparable to, or less than, the first cost of other types of year-around air conditioning systems, depending upon the expense of procuring the heat source. It is not possible to make a detailed study of the first-cost of solar energy heat pump systems here. However, Maria Telkes and E. Raymond[4] have given some cost data on the solar house built at Dover, Mass.

It is of interest to compare the electricity cost for the heat pump with the fuel cost for conventional systems using natural gas, fuel oil and coal. Fig. 8 allows direct comparison of unit electricity cost for the heat pump with unit costs for gas, oil, and coal for delivery of the same quantity of heat at equal cost and provides for graphically determining the heating cost per million Btu.

For example, consider a heat pump with a Coefficient of Performance (COP) of 4 and an electricity cost of 2 cents per KWH. For delivery of the same quantity

Table 10—Residential Costs of Electricity and Petroleum Fuels at Madison, Lincoln, Nashville, and New Orleans

City	Electricity ¢ per Kwh	Natural Gas ¢ per 1000 cu ft	No. 2 Grade Fuel Oil ¢ per gal
Madison	1.5	90	14.2
Lincoln	1.6	50	11.5
Nashville	0.4	75	13.8
New Orleans	2.0	55	12.0

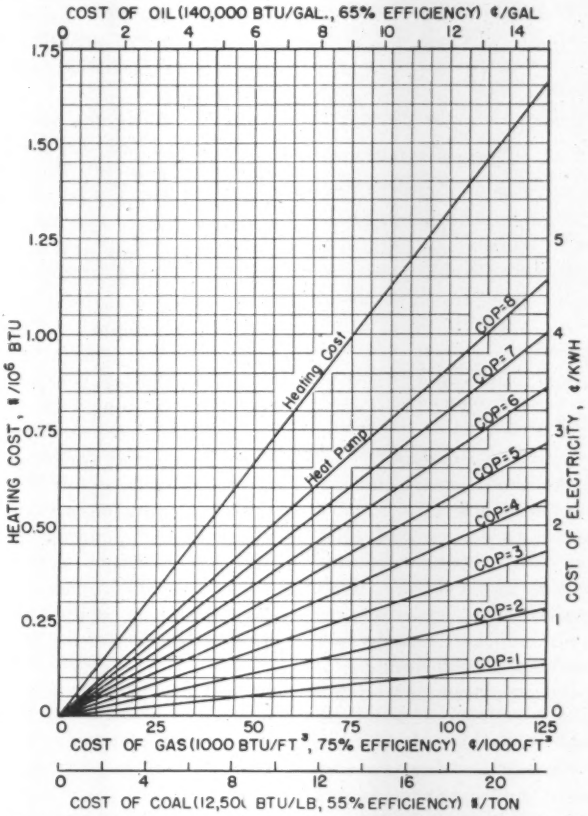


Fig. 8—Equivalent costs for heating with the heat pump and gas, oil and coal-fired systems and heating cost per million Btu

of heat at equal cost, gas must cost $1.10 per 1000 cu ft, coal about $19.75 a ton, and oil about 13.2 cents per gallon. (In all of these cases it costs $1.46 to deliver one million Btu of heat.)

The economic feasibility of a heat pump in regard to operating cost may be readily determined from Fig. 8 if the actual heat pump coefficient of performance and the unit costs for electricity and fuels are known.

Table 10 shows unit costs of electricity, natural gas, and No. 2 grade fuel oil for Madison, Lincoln, Nashville, and New Orleans. Each city has a residential rate schedule for electricity and natural gas and the costs shown in Table 10 are for those parts of the rate schedules in which the consumption of electricity for the heat pump and the consumption of natural gas for space heating would usually appear.

Table 11 shows the estimated fuel and heat pump costs for an average winter season (October 1 to May 1) for the four localities. The heat pump was taken as a two-step condensation type operated at 115 upper condensing temperature, 90 F lower condensing temperature, and 50 F evaporating temperature. The estimated actual coefficient of performance from a curve presented in a previous article[1] is 5.9. In figuring the electricity cost for the heat pump, the first 250 kwhr consumed per month were charged to other electrical appliances and in figuring the cost of natural gas the first 3500 cu ft consumed per month were charged to other gas appliances.

The heat pump costs shown are electricity costs for the compressor only, and no estimates of power consumption for transport of the fluid from the collector to the evaporator are included. Since this additional power consumption would be very small compared with that of the compressor, the values of Table 11 are in correct order of magnitude.

Table 11—Estimated Heating Costs for House of Fig. 1 for the Heat Pump and Fuel-Fired Systems for an Average Winter Season at Madison, Lincoln, Nashville, and New Orleans

City	Heat Required 10^6 Btu	Cost in Dollars		
		Heat Pump	Gas	Oil
Madison	126.5	94	162	199
Lincoln	106.0	78	72	135
Nashville	64.2	19	65	98
New Orleans	20.2	20	15	27

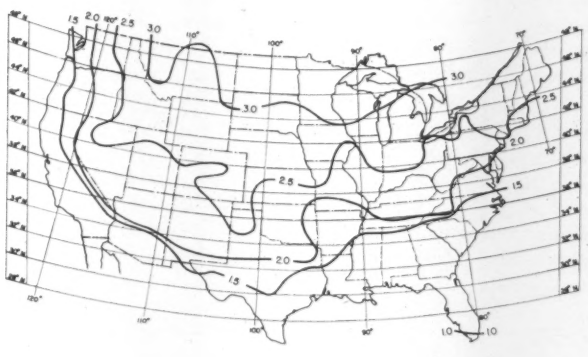


Fig. 9—Relative design heating load for the United States

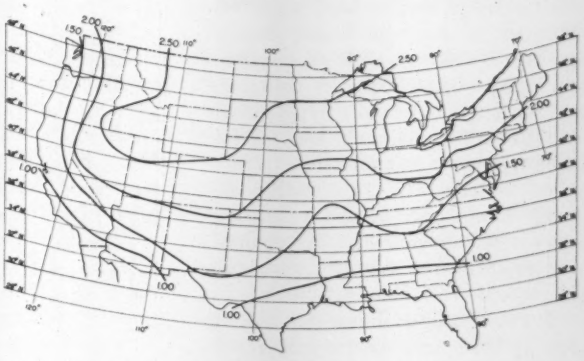


Fig. 10—Ratio of design heating load to design cooling load for the United States

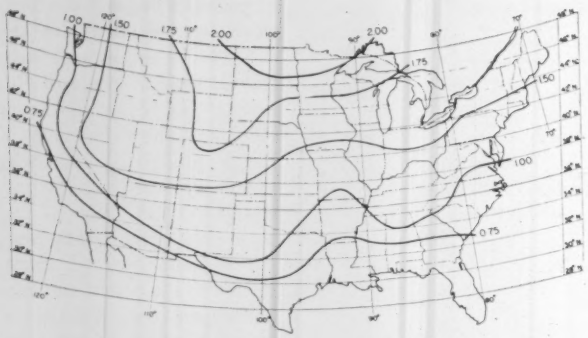


Fig. 11—Ratio of tons capacity required for winter heating (120 F condensing temperature, 40 F evaporating temperature) to tons capacity required for summer cooling for a dichlorodifluoromethane (F-12) system with no heat storage.

Table 11 shows that for the four localities the heat pump results in lower heating costs than fuel-fired systems, with the exception of natural gas systems at Lincoln and New Orleans. At Nashville and Madison the heat pump has substantially lower operating costs. The reason for the favorable showing of the heat pump is, of course, the relatively high evaporating temperature of 50 F assumed. However, in solar energy-heat pump systems, an evaporating temperature of 50 F may easily be attained.

Adaptability of Solar Energy Heat Pump Systems in the United States

Any home in the United States may be heated entirely by a solar energy heat pump system if a sufficiently large collector, heat pump, and heat storage facilities are provided. However, it has been shown that at Lincoln, Neb., a locality which has rather severe winters, a house with a design heating load of 62,000 Btu per hr may be heated during average winters with a system equipped with a 700 sq ft collector, a 4 hp heat pump, and a hypothetical but probably attainable heat of fusion type storage material requiring a volume equivalent to a small basement room. An auxiliary heating system of moderate size is required for supplemental energy during the infrequent, very cloudy winters.

It has also been shown that a solar energy heat pump system may result in heating operating costs substantially less than conventional fuel-fired systems. With the accelerated depletion of the world's petroleum resources it is reasonable to expect the relative operating economy of solar energy heat pump systems to become more favorable in the future. It is true at present that such systems would have a high first cost because of the need for custom building of the solar energy system, but standardization of collectors and heat storage units should reduce these costs and provide a system probably competitive in first cost and cheaper in operating cost than fuel-fired systems.

In order to discuss the feasibility of solar energy heat pump systems, it is necessary to analyze the demand for heating and cooling in the United States as well as the available radiation. Heating load and cooling load calculations were carried out for a conventional type house for approximately 100 localities. The same amounts of insulation were used in all calculations.

Fig. 9 shows the relative design heating load for the country. The maximum rate calculated was 3.38 at Duluth, Minn. Fig. 10 shows the ratio of design heating load to design cooling load. With the exception of a narrow belt of southern states and the extreme southwestern section, all regions of the country show a higher design heating load than cooling load. Fig. 11 shows the ratio of tons capacity for the refrigeration system (heat pump) that is required for winter heating to tons capacity required for summer cooling for systems with no heat storage. Winter operating conditions of 120 F condensing temperature and 40 F evaporating temperature for the heat pump were assumed. Fig. 11 was constructed by dividing each of the points calculated for Fig. 10 by a ratio of heat rejected in the condenser to heat absorbed in the evaporator of 1.34. Fig. 11 shows that a broad belt of southern states and the Pacific Coast region required a greater refrigeration system capacity for summer cooling than winter heating. The New England, Cornbelt, and Middle Rocky Mountain regions require about 50 percent greater capacity for winter heating, and a narrow section of Minnesota and North Dakota requires about twice as much capacity for winter

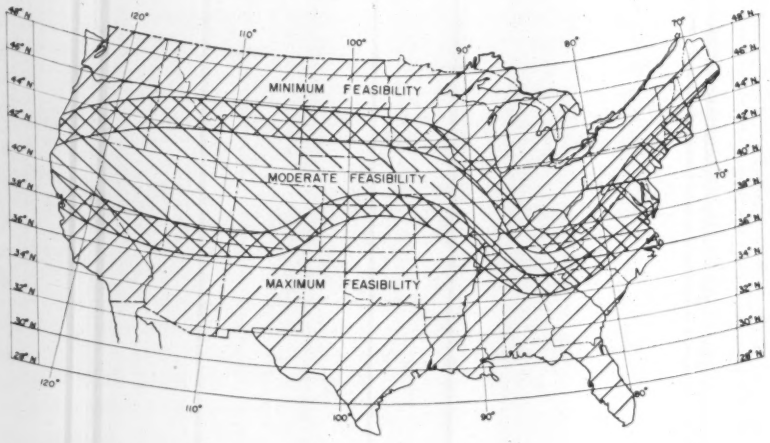


Fig. 12—Relative feasibility of solar energy heat pump systems in the United States

heating as for summer cooling.

It is necessary to consider the seasonal demand for heating and cooling as well as the peak demand. The seasonal heating requirement is proportional to the number of degree days for the locality. Degree-day data are well established and are available in tabular form in THE GUIDE[5] and in map form in *Heating and Ventilating's Engineering Databook*.[6]

There is no simple way of correlating the seasonal cooling demand for as yet no completely satisfactory method has been published. According to *Heating and Ventilating's Engineering Databook*,[6] the seasonal cooling requirement of some residences has been found to be proportional to the degree hours above 85 F and a map showing these data is given.

The feasibility of solar energy heat pump systems in the United States may now be discussed by considering the data presented here on heating and cooling demand and data on the availability of solar radiation presented in a previous article.[2] For maximum feasibility a locality should have a ratio of tons capacity for winter operation to tons capacity for summer operation of unity or less; a large amount of winter radiation incident upon a southfacing surface; a moderate number of degree days in winter; a large number of degree hours above 85 F in summer; and relatively cheap electricity.

Fig. 12 shows three zones of relative feasibility for the United States. The boundaries between the zones are approximate, since a considerable degree of judgment was exercised in their assignment. Fig. 12 was constructed by considering availability of radiation, the winter heating demand, and the summer cooling demand.

The dip of the zone of minimum feasibility to the south and east of the Great Lakes is due to the low amount of solar radiation in winter resulting from excessive cloudiness. For the same reason the zone of minimum feasibility was extended to include the Pacific Northwest. The peak of the zone of maximum feasibility in the Midwest is due principally to the high number of summer degree hours and the relatively large amount of solar radiation available in winter.

Conclusions and Recommendations

The conclusions and recommendations which follow are drawn from the entire series of three articles dealing with the availability of solar energy[2], the utilization of solar energy for residential heating[1], and the design and economics of solar energy heat pump systems.

Because of the steady depletion of our fossil fuel reserves, new sources of energy must be utilized in the foreseeable future to prevent degeneration of our standards of living. The use of solar energy for space heating is realizable and the sun's supply of energy is virtually inexhaustible.

The desirable orientation for a solar energy collector appears to be a south-facing vertical position. In regard to the availability of solar radiation incident upon a south-facing vertical surface in the United States during December and January, the maximum radiation available appears to be in the southwestern section of the country centered in the states of Colorado and New Mexico. A reasonably uniform radiation exists in the Mississippi Valley Region. The Pacific Northwest and the regions immediately south and east of the Great Lakes are characterized by low amounts of winter sunshine because of excessive cloudiness. Of the total daily radiation incident upon a south-facing vertical surface outside the atmosphere during December and January at 42 deg north latitude, about 45 percent is depleted by the atmosphere during cloudless days. Recorded totals of daily radiation at Blue Hill, Mass., indicate that about 70 percent of the radiation incident upon a south-facing vertical surface outside the atmosphere is depleted by the atmosphere during all days. Weather Bureau records show that the total radiation incident upon a horizontal surface at a given locality varies widely from year to year and that negative deviations from the long-time average of 30 percent or more may be expected. Weather Bureau records also show that at many localities sequences of winter days with above-average radiation are more common than sequences of days with below-average radiation and that very dark winter days when little solar energy may be collected are commonly days with above-average temperature. Very cold days are usually days with above-average incident radiation. These are important advantages in solar utilization systems.

A rational method has been presented for estimating the daily efficiency of a flat-plate type solar energy collector. The efficiencies calculated by this method are indicative of maximum efficiencies which may be expected in an actual collector. When the difference between the collector plate temperature and the daily average outdoor temperature is 50 F or less, daily efficiencies during January of 60 percent or more may be expected on clear days for a south-facing vertical collector. Solar energy heat pump systems may operate with a much lower collector plate temperature than direct solar utilization systems resulting in substantially higher collector efficiencies and smaller required collector surface. Calculations indicate that a flat-plate collector with a south-facing vertical orientation should be equipped with two glass panes in the northern part of the country and one glass pane in the southern part.

Any solar utilization system must include a heat storage facility if solar energy is to contribute more than a token part of the space heating requirements of a building. Because of their large heat capacity per unit volume and large heat capacity without large temperature change, heat of fusion type storage materials appear superior to specific heat or latent heat of vaporization types. In systems incorporating a heat pump, the heat storage facility should be placed on the evaporator side.

A rational design procedure has been presented for estimating col-

lector area, heat storage volume, heat pump specifications, and auxiliary heating capacity. This procedure may be used for any locality for which the proper solar statistics are available. In many localities a solar energy heat pump system may require components of moderate size. At Lincoln, Neb., a locality having rather severe winters, a house having a design heating load of 62,000 Btu per hour may be heated during average winters with a system equipped with a 700 sq ft collector, a 4-hp heat pump, and a heat storage facility using 460 cu ft of a heat of fusion type material (10,000 Btu per cu ft) placed on the evaporator side of the heat pump.

In many localities solar energy heat pump systems would result in lower heating costs at the present time than conventional fuel-fired systems. Substantially lower heating costs for such systems were calculated for Madison, Wis. and Nashville, Tenn. With steady depletion of the world's petroleum resources, it is reasonable to expect the relative operating economy of solar energy heat pump systems to be more favorable in the future. At present, such systems would have a high first cost because of the need for custom building of the solar energy system. However, with standardization of collectors and heat storage units, it would be possible to reduce these costs.

The main problems associated with the development of solar energy heat pump systems involve solar collectors and heat storage systems. No serious architectural problems appear to exist since a house may be designed to include a moderately large south-facing collector and yet retain architectural appeal and livable qualities equal to those of conventional homes. Solar energy heat pump systems appear feasible in a large part of the United States but further research and development is necessary before such systems may be adopted on a large scale.

The following topics appear to be sufficiently important to justify future research:

1. Pyrheliometric measurements of solar and sky radiation incident upon a south-facing vertical surface in all sections of the country to supplement the recorded data now available from the Blue Hill, Mass. Observatory.
2. Experimental studies on heat pumps using multiple-step condensers and flash chambers as to their coefficient of performance, construction, and operation.
3. Further studies on solar collectors to improve their efficiency, determine their proper construction, and evaluate their operating characteristics.
4. Development of heat of fusion materials suitable for evaporator-side storage, determination of their performance characteristics, and studies on packaging and arranging of these materials.
5. Field studies on complete solar energy heat pump systems.

References

1. Utilization of Solar Energy for House Heating, by R. C. Jordan and J. L. Threlkeld (ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, January 1954).
2. Solar Energy Availability for Heating in the United States, by R. C. Jordan and J. L. Threlkeld (ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, December 1953).
3. A Thermodynamic Study of Vapor Compression Heat Pump Cycles, by J. L. Threlkeld (*Refrigerating Engineering*, Vol. 61, November 1953, p. 1202).
4. Storing Solar Heat in Chemicals — A Report on the Dover House, by Maria Telkes and E. Raymond (*Heating and Ventilating*, Vol. 46, November 1949, pp. 85-86).
5. HEATING, VENTILATING, AIR CONDITIONING GUIDE 1953, pp. 437-439 (published by THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, New York, N.Y.).
6. *Heating and Ventilating's Engineering Databook*, by Clifford Strock (The Industrial Press, New York, 1948, pp. 5-63).

J. E. Haines Named to Research Post

The Building Research Advisory Board, a division of the *National Academy of Sciences*, Washington, D.C., coordinating and fact-finding board created to advance technical knowledge in all phases of the building industry, announces the appointment of John E. Haines, Minneapolis, Minn., as a member of BRAB.

Since its formation in 1949 it has worked with architects and hospital authorities in the development of a hospital planning research unit; has conferred with the U.S. Chamber of Commerce, architects groups and the U. S. Office of Education on reducing the cost of school buildings, and has worked with the Atomic Energy Commission on laboratory design for handling radioactive materials.

Members of the Building Research Advisory Board include executives of companies that are directly connected with the building industry, government officials and members of engineering school faculties.

Mr. Haines is first vice president of ASHVE and has been active in its affairs for many years.

AGA Distinguished Service Award to H. P. Morehouse

H. Preston Morehouse, assistant sales manager — gas, Public Service Electric and Gas Co., Newark, N.J., recently received the *American Gas Association's* Distinguished Service Award for his outstanding contributions to the gas industry. Presentation of the award was made by F. C. Smith, president of *AGA*, at the 55th annual convention of the gas industry

H. P. Morehouse
Newark, N.J.

trade association held in St. Louis, Mo.

The Distinguished Service Award is one of the top honors bestowed in the gas industry. It is given to the person who, in the opinion of the Board of Directors of *AGA*, has made during recent years an individual contribution of a distinguished or outstanding character in the general interest of the gas industry.

Mr. Morehouse, active in ASHVE affairs, was one of the organizers of the North Jersey Chapter which was chartered in 1952, and served as vice chairman of the Committee on Arrangements for the Society's 1952 Semi-Annual Meeting.

Effects of Non-Uniformity and Furnishings on Panel Heating Performance

By L. F. Schutrum* and C. M. Humphreys**, Cleveland, Ohio

This paper is the result of research carried on by THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS at its Research Laboratory located at 7218 Euclid Avenue, Cleveland 3, Ohio.

SUMMARY — Two previous papers have reported the results of experiments conducted in the ASHVE Environment Laboratory dealing with heat exchanges in a panel heated room under the rather idealized conditions of uniform surface temperatures and no furnishings.

This paper reports the results of work done in the Environment Laboratory to evaluate the effect of non-uniform surface temperatures, floor coverings, and room furnishings. The results are expressed as corrections which may be applied to the results given in the earlier papers.

SEVERAL YEARS ago a special room was constructed at the ASHVE Research Laboratory for the study of heat transfer within a panel heated space. This room, commonly referred to as the Environment Laboratory, is approximately 12 ft wide and 24½ ft long, and the ceiling is adjustable to any height up to 12 ft. Either the floor or ceiling, or both, may be heated, and all six surfaces may be cooled to any temperature or combination of temperatures desired. Cooled air may be introduced at six locations in the room to simulate infiltration. A detailed description of the construction and instrumentation of this room is given in an earlier paper.[1]

In December 1952 a paper[2] was published giving the results of tests made in the Environment Laboratory with a heated ceiling, uniform environment (all surfaces other than the heated ceiling at a uniform temperature) and with and without infiltration air. In June 1953 a second paper[3] was presented, giving the results of a similar series of tests made with a heated floor. Some indication of the modifying effects of non-uniform environment and room furnishings on panel heating performance was given in one of these papers.[2] A more complete investigation of these effects has been made, and the results are presented herein.

Effects of Non-Uniform Environment

Ceiling Panel: Tests were made in the Environment Laboratory with several ceiling temperatures, various configurations of wall and floor surface temperatures, and with various infiltration rates and temperatures. The actual combinations of these variables used in the tests are given in columns 3 through 8 and 10 and 11 of Table 1. In some of the tests one or more surfaces were neutral, that is, they were neither heated nor cooled, but were allowed to seek their own temperature level. Neutral surface temperatures are indicated by asterisks.

The AUST, which is the area-weighted average unheated surface temperature, is given in column 9 for each test.

The average heat output of the ceiling was determined experimentally for each test made with *non-uniform* environment, and is listed in column 12 of Table 1. Listed for comparison in the next column is the heat output which would have been obtained for the same ceiling temperature, infiltration, and AUST, but with a *uniform* environment. These latter values were taken from figures in Reference 2. It may be seen that the values in columns 12 and 13 are in close agreement. The deviation is within ± 5 percent for 33 of the 34 tests. The only exception is test No. 18.

The room air temperatures for non-uniform environment tests, taken at points 30 in. and 60 in. from the floor in the center of the room, are shown in columns 14 and 15 of Table 1. The next two columns indicate the air temperatures which would have prevailed for the same ceiling temperature, infiltration, and AUST, but with a uniform environment, as calculated from data given in an earlier paper.[2] Here again good agreement is shown between test results for non-uniform and predicted values for uniform environment. In 15 of the 18 tests recorded, the deviation in the air temperature at the 30 in. level is less than 1.5 deg. The deviation in temperatures at the 60 in. level exceeds 1.5 deg in only one test; however, in nearly all cases the deviation is positive, and indicates a temperature increase of approximately one degree attributable to non-uniform environment.

Floor Panel: A second series of tests was made to determine the effect of non-uniform environment with a heated floor panel. The test conditions, and the resulting panel heat

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Presented at the 60th Annual Meeting of THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, Houston, Tex., January 1954.

outputs and room air temperatures are given in Table 2. Also given are comparable values of panel heat output and air temperature predicted for the same floor temperature, infiltration conditions, and AUST, but with uniform instead of non-uniform environment. These values for uniform environment were determined from data presented in another paper.[3]

A comparison of the panel heat output rates for non-uniform and uniform environment given in columns 12 and 13 of Table 2 indicates good agreement. In two of the 10 tests, the difference is slightly more than 5 percent. It is interesting to note that although the differences in heat outputs are small, the output for the non-uniform environment is greater in every case. A further analysis of these results seemed to indicate that for a given floor temperature and AUST, the panel output increased with an increase in non-uniformity in surrounding surface temperatures. However, the maximum deviation due to non-uniformity of surface temperatures was so small that this trend was not considered significant.

From a comparison of the values listed in the last four columns of Table 2, it is evident that the degree of non-uniformity of surrounding surfaces has little or no effect on the air temperature at the 30 in. and 60 in. levels in a floor panel heated space. The maximum deviation at the 60 in. level is only 0.5 deg.

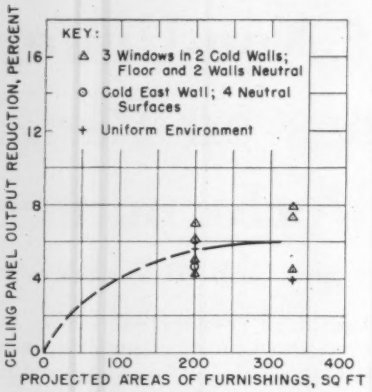


Fig. 1—Effect of furnishings on ceiling panel heat output
(24½ x 12 x 8 ft high room)

Effects of Room Furnishings

Two series of tests were made to determine the effect of room furnishings on the performance of floor panel and ceiling panel systems. In each series, tests were made with different panel temperatures, AUST values, infiltration conditions, and degrees of uniformity of environment, and with two different amounts of room furnishings.

For most of the tests, the furniture consisted of a davenport, five office arm chairs with leather seats and backs, a large table, two small tables, and three lamps. This amount of furniture, which had a total projected area of approximately 200 sq ft, was judged to be representative for a living room of comparable size. In a few tests, four more chairs and four more small tables were crowded into the room, thus increasing the projected surface area of the furniture to about 330 sq ft. The projected area of a piece of furniture was taken as the sum of its area as seen from the top, the bottom, and each of the four sides.

The introduction of furniture into the room caused a decrease in the heat output from both floor and ceiling panels. This decrease was directly proportional to the amount of furniture in the room, and was undoubtedly due to the obstruction provided by the furniture to direct radi-

Table 1—Ceiling Panel Heat Outputs and Room Air Temperatures for Non-Uniform and Uniform Temperature Environments *(24½ x 12 x 8 ft high room)*

Non-Uniform Conditions	Test No.	Room Surface Temperatures, F						AUST[a]	Infiltration		Panel Output Btu per (hr) (sq ft)		Room Air Temperature, F			
		Ceiling	Floor	North Wall	South Wall	East Wall	West Wall		Changes per hr	Temp F	Non-Unif.	Uniform[b]	Non-Uniform 30 in.	Non-Uniform 60 in.	Uniform[b] 30 in.	Uniform[b] 60 in.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
One long wall, cold.	187	89.8	64.9	64.1	64.7	45.6	64.7	60.5	none	—	28.3	29.0	61.7	63.3	61.6	62.8
	216	119.7	64.6	65.7	64.6	36.3	64.5	58.4	1.0	40.0	66.0	67.4	59.7	61.9	59.3	61.7
	217	119.8	64.7	65.7	64.6	36.2	64.4	58.4	none	—	68.0	67.0	60.5	63.5	60.7	63.3
	220	119.7	64.5	65.3	64.2	35.8	64.3	58.1	1.0	−0.6	68.0	68.7	56.6	59.7	55.7	59.7
	221	119.8	63.7	64.5	63.8	35.0	63.7	57.4	2.0	−2.4	69.7	70.1	51.4	55.6	50.0	55.6
One long wall, cold;	17	135.6	75.8*	69.4	67.7	28.0	67.2	61.8	none	—	87.7	84.2				
Floor, neutral.	18	105.9	65.9*	66.7	67.2	29.4	66.6	58.3	none	—	52.4	49.4				
	19	119.7	70.5*	67.2	66.0	29.1	66.0	59.5	none	—	67.8	65.4				
	20	119.8	75.2*	67.2	65.6	38.4	65.6	63.0	none	—	64.6	62.0				
	21	120.2	76.1*	67.1	65.4	46.5	65.4	65.0	none	—	62.4	61.2				
One long wall, cold;	26	129.1	63.0	74.2*	73.7*	27.8	73.4*	59.9	none	—	80.2	77.2	58.6	66.3	62.5	65.4
3 walls, neutral.	27	110.9	63.3	69.1*	68.3*	27.2	68.0*	57.5	none	—	58.4	56.2	57.8	62.9	59.5	61.8
	28	142.1	65.1	79.0*	78.4*	33.0	78.5*	63.9	none	—	94.8	91.0	62.2	71.1	66.8	70.2
One long wall,	71	119.7	78.3	78.8	77.3	85.0*	77.4	79.5	1.0	−0.6	47.1	47.8	73.5	79.0	74.3	79.0
neutral.	72	119.8	77.8	79.1	78.0	83.5*	78.0	79.3	2.0	3.0	51.1	48.8	68.7	74.8	68.3	75.0
	73	120.0	77.6	79.4	77.6	89.4*	78.1	80.5	none	—	45.8	45.5	81.3	84.8	82.0	83.7
	197	120.5	65.2	65.8	64.9	79.1*	64.0	68.2	none	—	57.3	59.0	70.0	74.4	70.2	72.4
	198	119.6	65.2	67.6	65.2	77.2*	65.6	68.1	1.0	39.8	58.7	58.9	67.0	71.1	67.8	70.0
3 simulated windows, 34 F[c];	114	109.7	79.6*	80.9*	66.3	66.7	79.6*	73.2	none	—	39.6	40.3	75.1	76.9	74.6	76.1
	115	89.5	71.8*	73.0*	67.9	67.9	72.0*	68.4	none	—	21.2	22.0	69.7	71.2	69.2	70.1
2 simulated outside walls;	116	106.7	75.2*	77.1*	67.5	67.6	75.6*	70.7	1.0	20.6	39.9	40.5	67.7	70.9	68.1	70.5
	227	90.3	71.7*	72.8*	68.0	67.2	71.9*	68.1	none	—	22.5	23.0	69.6	71.1	68.9	69.9
Floor, north & west walls, neutral.	228	90.0	68.5*	70.3*	66.9	67.0	69.5*	66.0	1.0	20.2	24.4	25.4	62.8	66.0	63.2	65.0

[a]Area weighted average temperature of the floor and walls.
[b]Uniform environment having the same ceiling temperature and AUST.
[c]One 4 x 5 ft window in center of south wall; two 4 x 5 ft windows in east wall.
*Neutral surface, neither heated nor cooled by liquid circulation.

ant heat exchange between the room surfaces.

The amount of this reduction, expressed as a percentage of the panel output for an empty room having the same conditions of panel temperature, infiltration, and AUST with uniform environment, is shown in Figs. 1 and 2 for ceiling and floor panel heated rooms respectively. It is interesting to note that in both cases, the reduction in panel heat output due to a normal amount of furniture is in the order of 5 percent.

Although the points from which the curves of Figs. 1 and 2 were drawn show considerable scatter, the shapes of the curves are as might be expected. With a heated ceiling, the furnishings can screen the cool floor and the lower part of the cool wall but can have no direct effect on heat transfer to the cold surfaces above the furniture. Therefore, the total effect of the furniture rapidly reaches a maximum as indicated by the reduction of slope in the curve with increasing area of furnishings. With a heated floor, the heat source is being screened from all of the cooled surface, and the curve shows no tendency to flatten within the limits of the tests made.

The surfaces of the furniture in a room are heated by radiation from the heating panel and heat is transferred by convection from these heated surfaces to the air, thus causing a higher air temperature in a

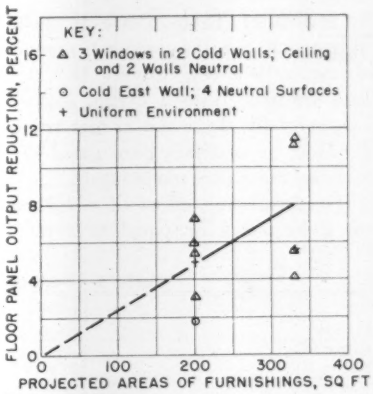


Fig. 2—Effect of furnishings on floor panel heat output
(24½ x 12 x 8 ft high room)

furnished room than would be found in an empty room with comparable room surface temperatures. The increase in air temperature varies with the amount of furniture surface area in the space, and with the difference between the panel surface temperature and the AUST. The room air temperature increase caused by a normal amount of furniture in ceiling panel and floor panel heated rooms is shown in Fig. 3. The increase is greater with a ceiling panel than with a floor panel because convection already accounts for a considerable portion of the floor panel output. The increases plotted in Fig. 3 were calculated from the dimensionless ratio (Air Temp—AUST)/(Panel Temp — AUST). See discussion of Figs. 4 and 5.

It should be noted that the decreased panel output and the increased room air temperature resulting from room furnishings were determined with the cold wall temperatures of the room held constant. This condition would not prevail in an actual installation. Instead, as the panel output decreased, wall surface temperatures, and therefore heat loss from the space and room air temperature would decrease somewhat. This would offset, at least to some extent, the trends noted above. The net effect of room furnishings on panel heat output and room air temperature may therefore be considered negligible for practical design purposes.

Effect of Floor Coverings on a Heated Floor Panel

To study the effect of floor coverings, experiments were conducted with three types of carpets, wool, rayon, and cotton. These carpets were selected by the manufacturer as being typical of the types and weights commonly used in residences. The carpets were used by themselves and in combination with two types of carpet pads, one of hair and jute, and the other of rubber. The wool carpet was large enough to cover the entire floor of the room. Each of the others, rayon and cotton, covered one half of the room and were always used together to secure complete floor coverage. A general

Table 2—Floor Panel Heat Outputs and Room Air Temperatures for Non-Uniform Temperature Environments
(24½ x 12 x 8 ft high room)

Non-Uniform Conditions	Test No.	Room Surface Temperatures, F						AUST[a]	Infiltration		Panel Output Btu per (hr) (sq ft)		Room Air Temperature, F			
		Floor	Ceiling	North Wall	South Wall	East Wall	West Wall		Changes per hr	Temp F	Non-Unif.	Uniform[b]	Non-Uniform 30 in.	Non-Uniform 60 in.	Uniform[b] 30 in.	Uniform[b] 60 in.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
One long wall, cold.	164	84.6	65.2	65.9	64.8	45.3	65.0	60.8	none	—	34.3	32.8	68.4	68.4	68.8	68.4
	168	84.6	65.0	65.4	64.8	26.2	64.9	56.4	none	—	42.4	39.5	65.2	65.2	65.9	65.4
	173	84.9	71.0	69.9	69.8	36.2	69.8	62.8	1.0	0.8	38.4	36.6	64.8	66.7	66.8	66.7
	174	85.2	70.2	70.7	70.3	45.6	70.3	64.8	1.0	40.0	31.6	30.2	70.0	70.0	70.1	69.8
	175	84.7	70.3	70.1	69.9	45.6	69.9	64.7	2.0	39.6	32.6	31.2	66.9	67.9	68.2	68.2
One long wall, cold; 3 walls and ceiling, neutral.	214	85.0	74.8*	73.5*	73.3*	58.4	73.5*	70.6	none	—	20.5	20.2	75.3	75.2	75.5	75.2
3 simulated windows, 34 Fe[c];	223	85.6	73.4*	73.4*	67.5	67.3	72.0*	68.8	none	—	24.3	23.5	74.2	74.2	74.5	74.2
	224	80.2	70.6*	70.0*	67.0	67.4	69.3*	66.7	none	—	19.2	18.2	71.1	71.1	71.3	71.0
2 simulated outside walls;	225	80.4	70.7*	70.2*	67.5	67.7	69.3*	67.0	1.0	20.1	22.6	21.9	68.2	68.6	68.8	68.8
Ceiling, north and west walls, neutral	226	84.8	72.9*	72.2*	67.1	67.2	70.6*	67.9	1.0	20.1	28.5	27.6	70.6	71.3	70.8	70.8

[a]Area weighted average temperature of the ceiling and walls.
[b]Uniform environment having the same floor temperature and AUST.
[c]One 4 x 5 ft window in center of south wall; two 4 x 5 windows in east wall.
*Neutral surface, neither heated nor cooled by liquid circulation.

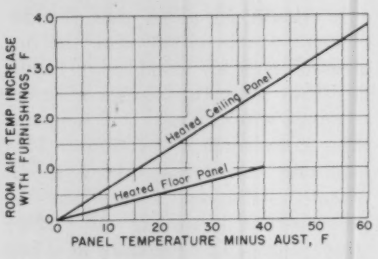


Fig. 3—Effect of normal amounts of room furnishings on the room air temperature at the 60 in. level at center of room
(24½ x 12 x 8 ft high room)

description of the carpets and pads is given in Table 3. The last column of the table gives the thermal conductance values for the carpets, pads, and the various combinations. Unless otherwise noted, these conductance values were determined from the experimental values of heat flow through and temperature drop across the floor covering. The values given are averages of the several tests made with each.

Table 4 lists the test conditions and the results obtained for a number of experiments with floor coverings. The experimentally determined average panel temperature under the carpet or pad is listed for each test in column 3.

The carpet surface temperatures given in column 7 were measured with a movable grid of thermocouples which was laid on the carpet surface. When in position the grid was slightly embedded in the carpet surface, but at least a part of the couples in the grid remained clearly visible to the observer.

The carpet surface temperatures given in column 8 were determined from the relationship previously established between AUST, temperature of a bare floor panel, and the room air temperature at the 60 in. level (see Figs. 7 and 10 of Reference 3). In a similar manner, the carpet surface temperatures in column 9 were determined from the established relationship between panel surface temperature, panel heat output, and AUST (see Figs. 1 and 4 of Reference 3).

The observed and calculated carpet surface temperatures in columns 7, 8, and 9 of Table 4 are in good agreement. This agreement demonstrates rather conclusively that the heat transfer from a carpet surface is essentially the same as the transfer from an ordinary bare panel surface at the same temperature.

The insulating effect of carpeting on a heated floor panel is evident from a comparison of panel and rug surface temperatures in columns 3 and 7 of Table 4. In test 262, Table 4, for example, the difference in these temperatures is approximately 44 deg. This means that to get the same panel output with a wool carpet and a hair and jute pad, the temperature of the heating medium would

Table 3—Description of Floor Coverings

Code	Description	Approx. Weights oz per sq yd	Conductance Btu per (hr) (sq ft) F deg
Carpet A	3 ply all wool	67	1.3
Carpet B	100 percent rayon, looped nap	65	0.8
Carpet C	100 percent cotton, straight nap	55	1.2
Pad A	40 oz, hair and jute	40	0.9[a]
Pad B	3/16 in. rubber pad	65	3.1[a]
Combinations:			
Carpet A and Pad A			0.53
Carpet A and Pad B			0.92
Carpet B and Pad A			0.42
Carpet B and Pad B			0.64[b]
Carpet C and Pad A			0.51
Carpet C and Pad B			0.87[b]

[a]These conductance values were determined from the results of tests made with various carpet and pad combinations.
[b]These values calculated from individual conductances.

Table 4—Effects of Floor Coverings on Heated Floor Panels
(24½ x 12 x 8 ft high room)

Test No.	Test Conditions	Panel Surface Temp F	AUST F	Floor Output Btu per (hr) (sq ft)	Room Air Temp 60 in. level	Carpet Surface Temperature, F		
						Measured[a]	Calc. from Air Temp[b]	Calc. from Heat Flow[c]
1	2	3	4	5	6	7	8	9
262	Uniform Environment No Infiltration Empty Room Carpet A, Pad A	124.5	64.7	23.3	69.8	80.6	80.6	81.7
263	Uniform Environment 1 Air Change at 20 F Empty Room Carpet A, Pad A	123.7	64.3	24.9	66.5	78.6	78.1	79.5
266	Non-Uniform Environment[d] 1 Air Change at 20 F Empty Room Carpet A, Pad A	127.3	69.7	24.5	71.2	82.1	82.3	84.5
267	Non-Uniform Environment[d] 1 Air Change at 20 F Furnished[e] Carpet A, Pad A	127.5	68.7	24.6	71.5	82.0	84.0	84.0
274	Uniform Environment No Infiltration Empty Room Carpet A, Pad B	100.2	64.8	19.9	69.5	78.0	79.5	79.3
273	Uniform Environment 1 Air Change at 23 F Empty Room Carpet A, Pad B	100.2	64.7	22.3	66.5	76.6	77.6	78.2
277	Uniform Environment No Infiltration Empty Room Carpet A	99.2	65.7	23.5	70.6	81.0	81.0	83.0
278	Uniform Environment 1 Air Change at 20 F Empty Room Carpet A	109.6	65.1	33.4	69.0	83.6	84.8	84.8

[a]Measured by thermocouple grid.
[b]Determined from Reference 3, Figs. 7 and 10.
[c]Determined from Reference 3, Figs. 1 and 4.
[d]3 simulated windows in two outside walls, ceiling and two walls neutral.
[e]Normal amount of furnishings, 200 sq ft of projected area.

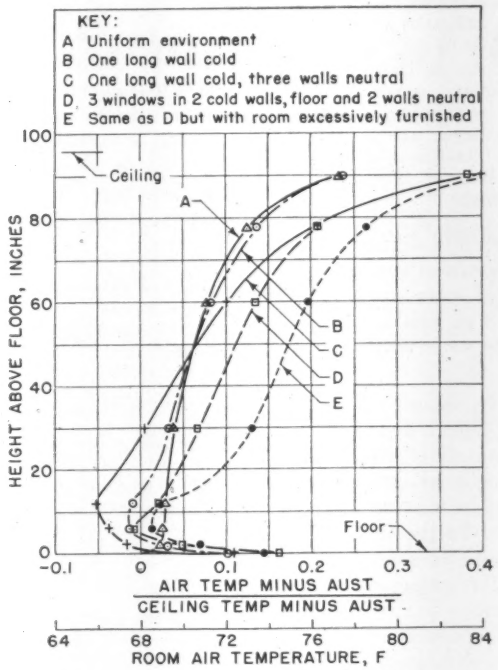

KEY:
A Uniform environment
B One long wall cold
C One long wall cold, three walls neutral
D 3 windows in 2 cold walls, floor and 2 walls neutral
E Same as D but with room excessively furnished
HEIGHT ABOVE FLOOR, INCHES
Ceiling
Floor
AIR TEMP MINUS AUST
CEILING TEMP MINUS AUST
ROOM AIR TEMPERATURE, F

Fig. 4—Floor to ceiling room air temperature gradient for a ceiling panel heated room
(No infiltration. Values adjusted to AUST of 68 F and ceiling temperature of 108 F — 24½ x 12 x 8 ft high room)

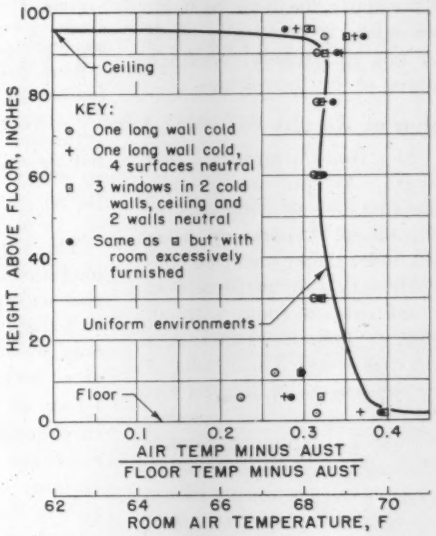

KEY:
One long wall cold
One long wall cold, 4 surfaces neutral
3 windows in 2 cold walls, ceiling and 2 walls neutral
Same as ▫ but with room excessively furnished
Ceiling
Uniform environments
Floor
HEIGHT ABOVE FLOOR, INCHES
AIR TEMP MINUS AUST
FLOOR TEMP MINUS AUST
ROOM AIR TEMPERATURE, F

Fig. 5—Floor to ceiling room air temperature gradient at center of room for a floor panel heated room
(No infiltration. Values adjusted to AUST of 62 F and floor temperature of 82 F — 24½ x 12 x 8 ft high room)

have to be at least 44 deg higher than if the panel were bare.

It will be noted that only the wool carpet was used in the tests listed in Table 4. Results with the rayon and cotton carpet are not included because, as previously pointed out, each of these covered only half of the floor area of the room. However, the effect of these carpets can be readily predicted from the conductance values given for them in Table 3. The temperature drop, $\triangle T$, through any floor covering may be calculated from the equation,

$$\Delta T = Q/C$$

where

Q = heat flow through the floor covering, Btu per (hour) (square foot)

C = conductance of the floor covering, Btu per (hour) (square) (foot) (Fahrenheit degree)

Of the floor covering combinations listed in Table 3, the lowest conductance of 0.42 is for carpet B and pad A while the highest conductance of 0.92 is for carpet A and pad B. The temperature drops required across these two combinations for a heat output rate of 25 Btu per (hr) (sq ft) would be as follows:

Carpet B - Pad A $25 \div 0.42 = 60$ deg
Carpet A - Pad B $25 \div 0.92 = 27$ deg

From the above comparison, it is evident that care should be taken in selecting floor coverings to be laid on heated floor panels.

Effect of Variables on Temperature Gradient

Fig. 4 is included to show the effect of non-uniform environment and furnishings on the floor-to-ceiling air temperature gradient in a ceiling panel heated room. All curves are adjusted to a 68 F AUST and a ceiling panel temperature of 108 F. The upper abscissa scale is a dimensionless ratio which may be used for any combination of ceiling panel temperature and AUST (also see Fig. 8, Reference 2 and Figs. 6 and 9, Reference 3). The lower scale relates the curves in terms of air temperatures.

Curve A for a uniform environment was taken from Fig. 8 of Reference 2. Curves B, C and D for varying degrees of non-uniformity in surface temperatures show some increase in gradient and some displacement to the right due to generally higher temperatures. Curve E, which is for the same conditions as curve D but with the addition of excessive furnishings, shows a distinct increase in air temperature.

Fig. 5 shows the effect of non-uniformity and furnishings on the floor-to-ceiling air temperature gradient in a floor panel heated room. The coordinates of the figure are similar to those of Fig. 4, but only the temperature gradient for uniform environment is plotted. The points for the other test conditions are shown. It will be noted that while there is considerable scattering of the points near the floor and some scattering near the ceiling, the temperature gradient

from 30 in. above the floor to 6 in. below the ceiling is practically unaffected by non-uniformity of surface temperatures or by furnishings.

Discussion of Results

Effects of Non-Uniformity and Furnishings: As previously indicated, the first testing programs in the Environment Laboratory were carried on under rather idealized conditions. All tests were performed in a given unfurnished room with all surfaces other than the panel at a uniform temperature. The results of this early work were of interest but could only be applied with reservation to actual design until a number of modifying factors could be studied. In reporting here on the effects of the non-uniformity of surface temperatures, room furnishings, and floor coverings, the work of the Research Laboratory is brought much nearer its ultimate goal, which is the development of simple and trustworthy design data on panel heating. Two other factors, the effect of room size and shape, and the effect of heating only a part of the floor or ceiling area, are still to be evaluated. The first of these is now under study and the second will be considered soon. Results of both studies will be reported in the near future.

It has been shown that the degree of the non-uniformity of unheated surface temperatures makes no significant difference in the performance of a panel heating system, and that this performance can be predicted on the basis of the AUST. It has also been shown that the effect of room furnishings on panel output and room air temperature may be neglected without appreciable error. These facts are indeed fortunate, for they will permit a considerable degree of simplification in design procedure.

For purpose of illustration, let it be assumed that the following conditions of design have been determined:

AUST ..... 68 F
Floor panel temperature ..... 85 F
Infiltration — 1 air change at zero F

From Fig. 1 of Reference 3, the heat output of the panel for an empty room with uniform surface temperatures and no infiltration equals 24 Btu per (hr) (sq ft).

From Fig. 4 of Reference 3, the increase in heat output due to infiltration as specified equals 6.7 Btu per (hr) (sq ft).

From this paper, corrections for room furnishings, and non-uniformity equals 0.0.

Therefore the total heat output which may be expected from the panel equals 24 + 6.7 + 0.0 = 30.7 Btu per (hr) (sq ft).

This value may be subject to slight modifications when the results of current work on the effect of room size and shape, and the effect of heating only a part of the floor or ceiling area, become available.

Effects of Carpeting: The effects of carpeting on heat output from a floor panel are of interest, not only to the designer of floor panel systems, but also to the person living in a house heated by such a system. To the designer, the large difference in water temperature required for carpeted and uncarpeted panels emphasizes the importance of having a separate coil or circuit for each room with ample provisions for balancing or controlling each circuit. The ordinary adjustable cock frequently installed for balancing is not likely to prove satisfactory where such large temperature differences are required. At least partial compensation may be obtained by using closer tube spacing under areas which are to be carpeted.

The person living in a floor panel heated home should select floor coverings having high thermal conductances. For instance, a rubber pad has much less effect on the operation of the heating system than a hair and jute pad.

The results given in this paper are for a floor completely carpeted. The effects of carpeting would decrease as the percentage of the carpeted area of the panel decreases. In rooms where most of the panel area is carpeted, it is quite likely that the temperature of the uncarpeted areas would be uncomfortably high.

With other than floor panel type heating systems, carpeting serves only as an insulation applied to the floor surface. This is particularly effective where floors are laid directly on the ground or are otherwise exposed.

Conclusions

All of the tests from which the following conclusions are drawn were made in the Environment Laboratory. However, these tests were made under such a variety of conditions that it seems reasonable to assume that they may be applied with satisfactory accuracy to any ordinary structure.

1. The performance of a panel heating system in a space having a non-uniform surface temperature environment can be predicted with satisfactory accuracy on the basis of the area weighted average unheated surface temperature (AUST) of the space.

2. Furnishings in a panel heated space tend to reduce the heat output of the panel, and increase the room air temperature. However, the net effect of these trends may be considered negligible for design purposes.

3. When a floor covering is laid over a heated floor panel, the surface temperature of that panel and the temperature of the heating medium must be considerably increased to maintain the same heat output to the space that would be obtained from the bare panel. For a heat output of 25 Btu per (hr) (sq ft), the amount of this temperature increase was found to vary from 27 deg to 60 deg for the various combinations of carpets and pads tested.

4. Coverings for heated floor panels should be selected to provide a minimum of resistance to heat flow from the panel to the space.

Acknowledgment

Acknowledgment is made to the Bigelow-Sanford Carpet Co., Inc., which supplied all of the carpets and carpet pads used in these experiments.

References

1. The ASHVE Environment Laboratory, by Cyril Tasker, C. M. Humphreys, G. V. Parmelee, and L. F. Schutrum (ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, Vol. 24, March 1952, p. 119).

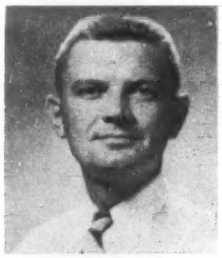
2. Heat Exchanges in a Ceiling Panel Heated Room, by L. F. Schutrum, G. V. Parmelee, and C. M. Humphreys (ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, Vol. 24, December 1952, p. 123).

3. Heat Exchanges in a Floor Panel Heated Room, by L. F. Schutrum, G. V. Parmelee, and C. M. Humphreys (ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, Vol. 25, July 1953, p. 133).

Summary of Chapter Meetings*

PRES. TAYLOR PRESENTS CHARTER TO 55th ASHVE CHAPTER

The Arizona Chapter, the 55th Chapter of the ASHVE, received its charter at a dinner meeting on December 2 at the Green Gables Restaurant. On hand to represent the Society was Reg. F. Taylor, ASHVE president for 1953, who presented the group with its charter and a gavel, which was a gift from the West Texas Chapter. The Arizona Chapter then voted to present a gavel to the next Chapter of the Society to be chartered. President Taylor, consulting engineer from Houston, Tex., then presented an address on the functions and operations of the Society.



A. J. Nelesen
Secretary
Arizona Chapter

V. J. Carns
President
Arizona Chapter

A. V. Hutchinson, executive secretary of the Society, was introduced and presented the Chapter with a Kardex unit for their membership files and a minutes book.

J. C. Park, dean of the College of Engineering, and Professor Thornburg, head, Department of Mechanical Engineering, both of the University of Arizona, extended their congratulations to the group upon receiving its charter and pledged the cooperation of the University. Walter Biddle, president of the Central Arizona Chapter of the *American Society of Professional Engineers*, presented greetings and congratulatory messages from his group and other local engineering societies as well as other ASHVE Chapters.

J. E. Scott
Treasurer
Arizona Chapter

It was announced that the following officers were elected to serve for 1954: *President*—V. J. Carns; *Vice President*—H. E. Kraft; *Secretary*—A. J. Nelesen, Jr.; *Treasurer*—J. E. Scott and *Board of Governors*—A. C. Baechlin. Attendance 60. Attendance ratio 0.80.

• *ARKANSAS*: The new officers for the 1954 season were elected at the Chapter's December meeting as follows: *President*—R. E. Blaylock; *Vice President*—W. J. Franklin; *Secretary*—J. L. Brown; *Treasurer*— J. W. Thompson; *Board of Governors*—J. C. Lewis, H. H. Himstedt, C. H. Miller, R. H. Combs, and Luther Granderson, Jr.

A panel discussion on *What My Business Means To the Industry* was the feature of the evening with President Cumnock acting as moderator and many Chapter members participating.

J. E. Thalmueller was appointed alternate on the Chapters Conference Committee and it was voted that he attend the 60th Annual Meeting in Houston. Attendance 26. Attendance ratio 0.34.

• *BRITISH COLUMBIA*: The Chapter held its Christmas dinner-dance in place of a regular December meeting. The smorgasbord-style dinner was served in the Totem Room at the Capilano Suspension Bridge, and was followed by dancing.

Pres. C. W. Leek extended a welcome to all members, wives and guests present, and later on moved that a vote of thanks be extended to the members of the social committee whose careful planning had provided such an enjoyable evening. Attendance 146. Attendance ratio 0.58.

• *CENTRAL NEW YORK*: Society President Reg. F. Taylor, consulting engineer, Houston, Texas, was the Chapter's guest at its November meeting held in the Elks Club in Rome, N.Y. President Taylor, who was introduced by Society Past President A. E. Stacey, Jr., spoke briefly concerning the Society's aims and activities.

*Note: The attendance ratios shown represent the membership attendance divided by the chapter membership. These ratios will be useful as a partial indication of interest shown by local chapter members in various types of subjects programmed by the various chapters and may be useful in deciding on subjects for chapter meetings.

The speaker of the evening, H. A. Lockhart, chief engineer, Bell & Gossett Co., Morton Grove, Ill., was introduced by K. T. Sprague. Mr. Lockhart discussed the selection of circulating pumps for use with various types of forced hot water heating systems.

Prior to the dinner meeting, the members were conducted on a trip through the modern plant of the Rome Cable Corp. Attendance 55.

• *CINCINNATI*: The Chapter held a joint meeting in December with the *American Society of Refrigerating Engineers* in the Engineering Society Building. The meeting was called to order by ASHVE Pres. R. C. Beineke, and a motion was carried that the group dispense with the regular meeting.

Consequently the group adjourned to the auditorium to hear Mr. Welsh of Carrier Corp. speak on *Residential Air Conditioning*. Attendance 82. Attendance ratio 0.39.

• *CONNECTICUT*: The November meeting of the Connecticut Chapter was called to order by Pres. G. F. Nieske at the Fairway Restaurant. A report on the chapter's finances was given by C. L. L'Hommedieu, treasurer, followed by a report from Carl Wahnquist, Jr. of the membership committee.

Reg. F. Taylor, president of the Society, and consulting engineer, Houston, Tex., presented an interesting talk entitled *Some Unusual Situations Encountered in Air Conditioning Design*. A hearty round of applause followed this valuable address. Attendance 49.

• *EMPIRE STATE CAPITAL*: The guest speaker at the December meeting was C. W. Lockhart, assistant sales manager, Buffalo Forge Co., Buffalo, N. Y. Mr. Lockhart began his talk by relating the late Dr. W. H. Carrier's experiences with Buffalo Forge Co. and then covered the company's general history. In his talk he covered the following subjects: propeller fans, centrifugal fans, and axial flow fans. In the very interesting question and answer period which followed, it was brought out that that there is no known method of determining decibel ratings of fans from fan noise at outlets in fan ducts. Outlet velocity is thought to be misleading in judging decibel ratings. Fan standards are set by several associations, including the *National Association of Fan Manufacturers* and the *Power Fan Manufacturers' Association*. Currently a powered roof ventilator code is being prepared. Attendance 35. Attendance ratio 0.47.

• *INDIANA*: The November meeting of the Indiana Chapter was held in the Construction League Building. Pres. R. C. Blackman called the meeting to order and the treasurer gave his monthly report, while the research committee gave a report on the work in progress.

H. W. Alyea, development and field engineer, Johnson Service Co., Milwaukee, Wis., was the speaker of the evening, and gave an absorbing talk on *New Trends in Temperature Controls*. Attendance 38.

• *INLAND EMPIRE*: Pres. G. M. Dieter called the November meeting to order in the Stone Room of the Spokane Hotel. Following the reading and approval of the minutes of the October meeting and the November board of governors meeting, reports were presented by the membership, attendance and program committees.

The guest speaker of the evening was Joseph Doyle, a prominent Spokane electrical engineering consultant. Mr. Doyle showed a motion picture film on the *Circuit Breaker, Its Function and Operation*. Mr. Doyle also had a panel set up to explain the function and operation of motor starters. His presentation pertained particularly to electrically operated mechanical equipment and emphasized the need for close cooperation between the mechanical and the electrical engineer during the design stages. A question and answer period followed the presentation and many opinions were given on how the specifications should be written regarding electrical work for mechanical equipment. Attendance 26.

• *IOWA*: The Chapter was honored to have J. E. Haines, second vice president of the Society, as the guest speaker at its December meeting. Mr. Haines, Minneapolis, Minn., spoke on *The Next Ten Years*. With the aid of slides Mr. Haines compared expenditures for 1943 with those in 1953 in the various major fields of industry and particularly in the fields of heating, ventilating and air conditioning. Mr. Haines projected these figures into the future, predicting corresponding expenditures in 1963.

John E. Haines
Minneapolis, Minn.

Pres. J. F. Sandfort called the meeting to order after which the minutes of the November meeting were read and approved and the remainder of Chapter business taken care of. Attendance 37.

• *IOWA*: Pres. J. F. Sandfort presided at the November meeting which was held in the Standard Club in Des Moines. Following the introduction of guests, the report of the auditing committee was presented by D. E. Schroeder. President Sandfort then presented R. H. Schnell with a past president's pin and expressed the thanks of the Chapter for the services he rendered as Chapter president during the 1952-53 season.

Massachusetts Chapter's October meeting heard J. A. Marshall, director of the School Assistance Commission, give food for thought on the aims and objectives of his Commission. (*l.* to *r.*) R. T. Kern, W. G. Martin, Jr., W. G. Burbo, A. L. Hare, Mr. Marshall, G. W. Sprague, M. I. Kischler

Harold Kersey, building manager of the Equitable Building, Des Moines, Ia., spoke on *Mechanical Equipment and Operating Costs of a Modern Office Building.* In his talk he covered heating, ventilating and air conditioning, operating costs and maintenance problems. A question and answer period followed. Attendance 26.

• *KANSAS CITY*: The meeting was held in the Wishbone Restaurant and was called to order by Pres. G. H. Stoffer. Large attendance at the Society's 60th Annual Meeting in Houston in January was urged; and discussion of a possible Spring Party was postponed until the January meeting.

F. K. Ladewig, program chairman, introduced the speaker of the evening, R. N. Lane, assistant director of the Acoustics Division of the Defense Laboratory, University of Texas, Austin, Tex. Mr. Lane spoke on *Noise Control in Heating, Ventilating and Air Conditioning Systems.* Following his interesting presentation, a lively question and answer period was conducted. Attendance 77. Attendance ratio 0.28.

• *MASSACHUSETTS*: The December meeting was a joint social meeting with the *American Society of Refrigerating Engineers*, held in the Charter Room of New England Mutual Hall.

The speaker of the evening was Dr. Gerald, Danish humorist and mystic, who performed many fascinating demonstrations of mind reading and thought control.

It was generally agreed that this was by far the most successful joint meeting the two groups had ever held. Attendance 188.

• *MASSACHUSETTS*: The Society's President, Reg. F. Taylor, consulting engineer from Houston, Tex., was the guest speaker at the Chapter's November meeting. Mr. Taylor gave a very interesting talk on *Some Unusual Situations Encountered in Air Conditioning Design* using as a basis his many years as a consulting engineer. Mr. Taylor indicated the reactions of the public to air conditioning after they had lived with it for awhile. He also covered several aspects of air conditioning systems including the practice of operating engineers in defeating the engineer's design and public reaction to air conditioning temperatures in the Houston area.

A description of the central plant of the University of Houston and of the air-to-air heat pump operated by a natural gas engine, used for air conditioning his home, concluded Mr. Taylor's talk.

The meeting was preceded by a social hour and dinner, after which W. F. Austin gave a brief report on the technical sessions at the Semi-Annual Meeting in Denver. Attendance 55.

• *MINNESOTA*: The December meeting was held at the Hasty Tasty Shop with William Sturm presiding in place of Pres. V. E. Pearson. President Pearson was voted member and Vice Pres. J. A. Craig alternate member to represent the Chapter on the Chapters Conference Committee. Prof. A. B. Algren, chairman of the by-laws committee, recommended that the Chapter's by-laws be revised to conform to the Model By-Laws for ASHVE Chapters. It was voted that the revisions be made and that the by-laws be submitted to the Society for approval.

Burning of Industrial Fuels Safely Is Everybody's Business was the subject of the talk given by L. D. Sibley, vice president and general manager of Combustion Control Corp., Boston, Mass. Mr. Sibley's talk was very interesting and emphasized the importance of the proper handling of gas fired industrial boilers. Attendance 114.

• *MISSISSIPPI*: The Mississippi Chapter elected new officers for the coming year at its recent monthly meeting held at the Walthall Hotel in Jackson.

I. E. Rowe, engineer for United Gas Corp., Jackson, was elected president, succeeding Burt Lomax, Jr., consulting engineer in Jackson. Other officers elected include: *Vice President*—Jack Davis; *Treasurer*—T. E. Stepan; *Secretary*—M. E. Price; The *Board of Governors* include: F. H. North, R. E. Vernon, Robert Porter, O. F. Rogers, and J. W. Taylor.

The Mississippi Chapter presented a gavel to the newly formed West Texas Chapter in Lubbock, Tex.,

I. E. Rowe, newly elected president of Mississippi Chapter, accepts gavel from retiring president Burt Lomax, Jr. *(right)* at recent meeting in Jackson

in keeping with a tradition that the youngest chapter should present the newest group with a gavel.

• *NEBRASKA*: H. H. Ulrich was the presiding officer at the Chapter's December meeting held at the Rome Hotel. Following the self-introduction of guests, the speaker of the evening, H. W. Paul, who is in charge of new products development, Glass Fibers, Inc., Toledo, Ohio, was introduced. Mr. Paul discussed the fiberglass industry as related to mechanical engineering. A discussion period followed the talk. The meeting was adjourned at 10:15 p.m. Attendance 35.

• *NORTH JERSEY*: O. S. Lieberg, president, American Caliqua Co., New York, N.Y., was the speaker of the evening. Mr. Lieberg spoke on *High Temperature Water Systems and Applications* using slides giving diagrams of typical systems, along with photographs of the equipment used. He stated that the use of high temperature high pressure hot water systems had been widely employed in Europe for many years with notable success, and that installations in this country were being made in increasing numbers. The talk was well presented and the question and answer period which followed indicated widespread interest in the subject.

A rising vote of appreciation was extended to Mr. Lieberg at the conclusion of the meeting.

Vice Pres. H. M. Patrick presided at the meeting in the absence of Pres. F. H. Faust. Attendance 100.

• *NORTHERN OHIO*: The meeting was called to order by Pres. J. M. Black in the Mather Room of the Allerton Hotel. The minutes of the October meeting were read and approved, and the treasurer and the membership committee chairman made reports. R. G. Huebscher, acting secretary, read two memos from the Society, the first concerning THE GUIDE and TRANSACTIONS, and the other concerning the post-meeting trip to Mexico. He also read a letter of resignation from the Chapter secretary, M. L. Erickson, who had taken a position with the University of Minnesota. Sherwood Nassau was thereupon elected the new Chapter secretary.

The speaker of the evening was P. L. Geiringer, chief engineer, American Hydrotherm Corp., New York, N.Y., who addressed the Chapter on *High Temperature Water Heat Distribution Systems*. Mr. Geiringer defined high temperature hot water distribution systems as those using hot water at temperatures between 200 to 450 F. He stated that other heat carriers are used also although he only covered this particular system in his delivery. Slides were shown presenting typical systems and pointing out that the boilers usually have forced circulation and water walls. Circulation pumps are used between the boilers and loads. He pointed out a number of the advantages of hot water distribution systems over steam distribution systems. Attendance 75.

• *OKLAHOMA*: The November meeting was presided over by Pres. F. X. Loeffler, Jr., and was called to order at Beverly's Drive-In. W. J. Collins, Jr., presented two new members to the Chapter and a welcome was extended to these men.

W. E. Gleeson, sales promotion manager of McDonnell and Miller, Inc., Chicago, Illinois, was introduced by A. C. Shelley. Mr. Gleeson presented a discussion on safety controls on boilers and other pressure vessels. The subject was illustrated by slides and Mr. Gleeson stressed the reliability of *ASME* codes dealing with safety devices and the need for following these codes. He also discussed the responsibility of the industry in general in educating consulting engineers, contractors, and operating engineers in the proper selection, application, and the maintenance of safety devices as a means of protecting life and property against failures resulting from inadequate or improperly applied safety devices. The hearty round of applause that followed was well deserved for such an informative and enjoyable discussion. Attendance 64. Attendance ratio 0.48.

• *ONTARIO:* A. J. Strain, Rund Mfg. Co., Toronto, was the guest speaker at the December meeting. *The Effect of Natural Gas on Heating and Air Conditioning Installations in Central Ontario* was the title of Mr. Strain's most informative and interesting speech. A lively discussion period followed his talk which was well received.

K. E. Gould reported on the *Onto-Houston* activities and he urged all those who could possibly attend the 60th Annual Meeting in Houston to make a special effort to do so.

This was the Ontario Chapter's Annual Christmas party, therefore all business was quickly completed and the gaiety of the evening was underway. Santa Claus made his very welcome appearance and distributed gifts and hearty holiday wishes to all. A pleasant and enjoyable time was had by everyone. Attendance 149.

• *PACIFIC NORTHWEST:* The December meeting of the Pacific Northwest chapter was called to order at the Stewart Hotel by Pres. H. T. Orebaugh.

T. C. Caskey, program chairman, presented W. O. Stevens, consulting engineer in the Northwest. Mr. Stevens, who specializes in the field of power plants and pulp and paper mills, spoke on the subject *The Design and Operating Problems of Heat Recovery Boilers*. His talk was illustrated with slides and a question and answer period followed this interesting talk.

President Orebaugh announced the proposed plans for a joint meeting with the *ASRE* for January after which the meeting was adjourned. Attendance 50. Attendance ratio. 0.39.

• *PACIFIC NORTHWEST*: T. C. Caskey introduced the guest speaker of the evening, Lloyd Gardner of the

Boeing Airplane Co. *Air Conditioning and Ventilation of Modern Aircraft, Including Jet Types* was the title of his discussion. Mr. Seterberg also of Boeing Airplane, assisted Mr. Gardner in the presentation of the reports, graphs, slides, etc. The program was enjoyed by all and a hearty round of applause followed.

Five new committees and their chairmen were announced as follows: *Nominating* — W. B. Pride; *Auditing* — W. J. Olson; *Membership* — J. A. MacDonald; *Entertainment and Attendance* — S. D. Peterson; *Publicity* — T. C. Caskey.

President Orebaugh called the November meeting to order at the Stewart Hotel. Attendance 55. Attendance ratio 0.46.

• *PHILADELPHIA*: Prof. E. R. Queer, director and professor of engineering research, The Pennsylvania State College, State College, Pa., spoke to the Chapter at its December meeting on *Condensation Control in Buildings*, a talk which occasioned considerable discussion. Professor Queer was introduced by John Everetts, Jr.

The Engineers Club was the meeting site and C. F. Dietz presided. He introduced J. W. McElgin, who is to be the general chairman of the Committee on Arrangements for the ASHVE 61st Annual Meeting of the Society to be held in Philadelphia, January 1955.

The revised by-laws of the Philadelphia Chapter, which had been approved by the Council, were voted upon and approved by the members. Attendance 74. Attendance ratio 0.21.

• *PITTSBURGH*: The members and their guests, including members of the *ASRE*, attended the Playhouse Theater to see *Affairs of State* for the December meeting.

• *SACRAMENTO VALLEY*: The December meeting was called to order by Pres. E. C. McKinsey who announced the appointment of L. A. O'Meara as ASHVE representative to the local engineering council. Reports were presented from the treasurer and the program chairman.

F. A. Connolly, Harvey H. Holland Co., and James Tomlinson, Technical Control Section, Owens-Corning Co., spoke on *Trials and Tribulations of a Service Man* and *Development and Future Prospects for Glass Fiber*, respectively. Mr. Connolly described some of the problems encountered by a service man in his daily work, while Mr. Tomlinson presented a description of the development of the glass fiber industry and its development potential for the coming years. Attendance 53. Attendance ratio 0.44.

• *ST. LOUIS*: *Trends in Standardized Boiler Design*, a talk by Otto deLorenzi, Combusion Engineering Co., was the highlight of the November meeting. In his talk Mr. deLorenzi first stated his preference for the term, *steam operating unit* rather than *boiler*. In his opinion the term boiler horsepower is obsolete and unrealistic. He prefers ratings in terms of pounds of steam per hour.

The horizontal return tubular boiler was passing out of the picture in favor of the water tube boiler which, in addition to being more efficient, has several other advantages, one of them being that, because of less water capacity in the water tube boiler, an explosion would result in considerable smaller release of energy and, therefore, less damage. Units larger than 50,000 lb of steam per hour were made up of standard assemblies or increments to accommodate any type of fuel or load conditions. Mr. deLorenzi showed several slides of package type units which are complete requiring only their being connected to the steam, water, electric, fuel lines. These are available in sizes from 4,000 to 30,000 lb of steam per hour. He also showed a slide of and discussed a high pressure hot water boiler having a capacity equivalent to 100,000 lb of steam per hour. These are equipped with pumps to, as Mr. deLorenzi expressed it, control the circulation through the boiler tubes, each one of which is equipped with an orifice where it enters the circulating header. During the question and answer period which followed the talk, he stated that most boilers require water treatment. He also stated that horizontal return tubular boilers generally have about a 4 percent lower efficiency than water tube boilers due to the outlet gases being about 100 to 125 deg higher and that the reasonable life of a water tube boiler is about 30 years.

Several announcements were made and reports of several committees were presented at the business meeting, at which Pres. H. C. Sharp presided. A Life Membership Certificate was presented to A. A. Ahlff by B. L. Evans, member of Council. A brief discussion was held concerning investment of Chapter funds which now amount to $972.48. W. A. Russell was asked to report on this matter at the next Board of Governors meeting.

• *SHREVEPORT*: The highlight of the November meeting was an address by E. K. Campbell, Kansas City, Mo., president of the Campbell Heating Co. and former member of Council and treasurer of ASHVE, who was introduced by Program Chairman, J. S. Malahy, Jr. Mr. Campbell presented a resume of the heating and ventilating industry from the time of Benjamin Franklin to the present day.

Several announcements of interest to the members were made by Pres. M. A. Hudson, who presided. Reports of the membership and special events committees were presented. Attendance 41. Attendance ratio 0.42.

• *SHREVEPORT*: Society First Vice Pres. L. N. Hunter, Johnstown, Pa., and vice president, Research, The National Radiator Co., presented an excellent talk *The Rating of Heating Boilers* at the October meeting. In his talk, Mr. Hunter discussed the I=B=R, *SBI* and *AGA* codes covering cast iron and steel boilers.

L. N. Hunter
Johnstown, Pa.

He explained the various ratings and their applications.

Pres. M. A. Hudson presided and several committee reports were presented. All members were urged to pay their dues promptly. The membership committee report emphasized the benefits of ASHVE membership and the importance of all Society members to work actively to support and contribute to Society activities and programs. Attendance 54. Attendance ratio 0.61.

• *SOUTHERN CALIFORNIA*: The November meeting was called to order by Pres. L. B. Davenport.

The speaker of the evening F. H. Green, AiResearch Manufacturing Co., presented a most unusual and informative discussion entitled *Air Conditioning of Ships in Space*. Mr. Green was assisted by Harry Chapman, who presented the display of the many atmospheric conditions required by standardized tests. These tests were given in evidence of what might be expected in the design of equipment for ships traveling in space. Mr. Green's talk involved the extrapolation of known conditions and the methods used to combat them. A space ship would present problems arising from the almost total absence of gravity. No convection could exist because there would be no cold column to force a warm column to the top of any space. If flames could not exist because no draft could provide additional oxygen, the conception of a standard centrifugal fan removing air would have to be modified. The speaker pointed out that the air for human survival would not be available and perhaps liquid oxygen would supply the human need. CO_2 from respiration could be disposed of chemically and the by-products of cooking, etc. would be condensed on cold surfaces. Mr. Green pointed out that energy might even be obtained from the difference in temperature between the hot and cold sides of a space ship. Considerable imagination was evidenced in the discussion that followed and everyone agreed that this was enjoyably different. Attendance 97.

• *SOUTH TEXAS:* L. N. Hunter, first vice president of the Society, was the speaker at the November meeting and his talk covered the *Rating of Boilers*. Mr. Hunter's speech was well received and an interesting question and answer period followed.

J. C. Lewis, treasurer, presented his report on the Chapter's financial status and D. M. Mills, general chairman of the Committee on Arrangements for the 1954 Annual Meeting and B. P. Fisher, publicity chairman, spoke on the forthcoming Houston meeting.

Pres. E. G. Floeter, Jr. called the November meeting to order at the Alabama Catering Service. Attendance 170. Attendance ratio 0.69.

• *UTAH:* William Stewey presented a film entitled *Principles of Controls* prepared by the *Instrument Society of America*. This film dramatized some of the basic principles common to the control problems in the heating and air conditioning field. George Winslow, industrial engineer for the Minneapolis-Honeywell Regulator Co., elaborated on the principle of control and led a discussion on the subject which followed. Both Mr. Stewey and Mr. Winslow received a hearty round of applause for their informative and entertaining presentations.

Prof. W. R. Olsen, School of Engineering, University of Utah, proposed that a conference on heating and air conditioning be held at the University and that it be scheduled for the latter part of April. The conference would feature a display of equipment; presentation of papers on such subjects as controls, radiant heating, high velocity duct design, heat pump, solar heating, and other related subjects. A motion was made and carried that the Society would go on record as approving the conference outlined by Professor Olsen.

Pres. M. L. Gollaher presided and with the reading and approval of the minutes, the meeting was adjourned. Attendance 26.

• *WASHINGTON, D. C.:* Pres. J. G. Muirheid called the November meeting to order at the Washington Hotel. President Muirheid announced that a private railroad car

ASHVE president Reg. F. Taylor presents West Texas Charter to R. A. Mixon, president of Chapter, at its meeting on December 1, at Caprock Hotel, Lubbock, Tex. (*l.* to *r.*) A. V. Hutchinson, executive secretary of ASHVE, President Taylor, J. C. Wharton, treasurer, Mr. Mixon, R. B. Carow, secretary, and L. C. McKay, vice president

would be available for all those attending the 60th Annual Meeting in Houston and he strongly urged all to attend.

L. G. Humphrey, Jr., chairman, Meetings Committee, then introduced the speaker, Donald Vance, vice president and executive engineer, Korfund Co., Long Island City, N. Y. His subject was *Vibration and Noise Control.* Mr. Vance discussed the theory of noise in air conditioning systems — those added by machinery and their percent of transmissibility, and disturbing frequencies. He showed that by isolating the lowest frequency, the higher ones are taken care of and he further showed examples of several ways in which various mounting materials may be used for the elimination of these noises. There followed a long and enlightening discussion period, resulting in adjournment at a much later hour than usual. Attendance 63. Attendance ratio 0.37.

• *WESTERN NEW YORK*: The Chapter's Annual Christmas Party was held at the University Club. The party began at 7:30 p.m. and was an informal affair, including bowling and card games. Later in the evening the group adjourned to the banquet hall for distribution of gifts by Joseph Davis, D. J. Mahoney, and Pres. C. W. Stone. An excellent buffet supper was served concluding a very enjoyable evening. Attendance 79. Attendance ratio 0.66.

• *WESTERN NEW YORK*: Pres. C. W. Stone presided at the November meeting held at the University Club and welcomed the large visiting group from the *ASRE*. Acknowledgment was made by Pres. R. J. Hess of the Buffalo Section of *ASRE*.

The guest speaker was F. M. Johnson, sales manager of Kathabar Division of Surface Combustion Corp., Toledo, Ohio. In a talk illustrated by slides he described *Humidity Control Systems for Comfort and Processing.* Attendance 84. Attendance ratio 0.38.

• *WISCONSIN:* F. J. Nunlist, Jr., vice president in charge of sales, Mueller Furnace Co., Milwaukee, Wis., was the speaker of the evening and his talk was entitled *Recent Developments in Warm Air Heating.* Mr. Nunlist began his talk by telling of the various residences which had been in use at the University of Illinois for tests on warm air heating. He described the types of systems which were used, namely radial and loop perimeter, and also stated that floor registers having vertical discharge or diffusing blades were tested. There were many questions which were answered by Mr. Nunlist and his talk was further illustrated by slides. An interesting and entertaining evening was had by all.

Pres. N. E. Hill called the December meeting to order at the Engineering Society of Milwaukee and after reports from the membership and finance committees the meeting was adjourned. Attendance 75. Attendance ratio 0.23.

• *WISCONSIN*: Together with the members of 10 other local engineering societies and the *Engineering Society of Milwaukee*, the members of the Wisconsin Chapter met at the Public Service Building auditorium to hear a talk by Maj. Gen. S. D. Sturgis, chief of the Corps of Engineers, U.S. Army, who discussed the St. Lawrence Seaway.

General Sturgis stated that the Seaway would be of great benefit to the United States by providing for low cost movement of high grade iron ore from Labrador to the nation's steel mills. It would also be of benefit, he stated, to the port cities of the Great Lakes region. According to General Sturgis, the question is no longer whether the seaway will be built or not as Canada is preparing to build it alone. The only question now is whether the United States is desirous of participating in its construction and operation.

There was no business conducted at the November meeting at which S. J. Gates, president of the *ESM*, presided. There was an audience of over 3000. Attendance ratio 0.25.

STUDENT BRANCHES

• *OKLAHOMA A. & M.*: The November meeting was opened by Pres. R. P. Schmidt. The minutes of the previous meeting were read and approved, followed by President Schmidt's report on an *OIT* Council meeting.

C. E. Durrett, secretary of the Student Branch, introduced the guest speaker, J. R. von Gonten, chief engineer, Tulsa Temperature Control Co., who spoke on *How an Air Conditioning Business Should be Run.* Mr. von Gonten centered his talk around the sales and service duties of a business engaged in year 'round comfort air conditioning. His talk was well received. Attendance 21.

• *OREGON STATE COLLEGE:* The October meeting was called to order by Pres. David Marx in the Engineering Laboratory, Oregon State College.

Omer Jacobson, an active member from Portland, introduced J. Donald Kroeker, of J. Donald Kroeker & Associates, Portland, Ore., who spoke on air conditioning in the Portland area and gave many interesting facts relating to the future of air conditioning in Portland. He also spoke on air conditioning on a national scale. The history of the ASHVE was briefly discussed, giving the OSC students further information and a more intimate view of the Society. An interesting question and answer period followed.

• *UNIVERSITY OF TORONTO*: The November meeting was called to order by Student Pres. Alexander Tudor in the Mechanical Bldg. This meeting officially opened the 1953-54 season of the Student Branch.

The speaker of the evening, H. D. Henion, sales manager of C. A. Dunham, Ltd., spoke on *Steam Heating, Its Development and Application.* This was a most interesting discussion and a lively question period ensued. At the conclusion of the meeting, copies of the book entitled, *Heating System Design*, by C. A. Dunham, Co., Ltd., were presented by Professor Ewens to the students. Attendance 15.

Candidates for Membership

The Society's By-Laws require that all applications for membership or advancement are to be sent to the Executive Secretary and the names of applicants and their references shall be printed in the next issue of the JOURNAL of the Society, or mailed to all members. When the replies are received from references the Candidate's application shall be submitted to and acted upon by the Admission and Advancement Committee as soon as possible.

When the Admission and Advancement Committee has acted favorably upon a Candidate's application and assigned his grade, the Council shall confirm the election of the proposed Candidate for membership. During the past month there have been 103 applications for membership, including 19 students, 2 reinstatements; in addition 8 advancements have been received. The names of these men and their sponsors are published in the following list.

Members are requested to scrutinize the list with care. The Admission and Advancement Committee, and in turn, the Council, urge members to assume their share of responsibility of receiving these candidates into membership by advising the Executive Secretary promptly of any whose eligibility for membership is in any way questioned.

All correspondence in regard to such matters is strictly confidential, and is solely for the good of the Society, which it is the duty of every member to promote.

Unless objection is made by some member by February 27, 1954, these candidates will be voted upon by the Council. Those elected to membership will be notified by the Executive Secretary immediately after election.

Note: †Reinstatement. *Non-member. △Advancement.

Arizona

ANDERSON, F. A., Engr., Valley Sales and Service, Inc., Scottsdale. REFERENCES: A. C. Baechlin, Jr., W. A. Biddle, P. A. Engebretson, J. E. Scott.

CONARD, W. F., Estimator, J. H. Welsh & Son Contracting Co., Phoenix. REFERENCES: A. C. Baechlin, Jr., W. A. Biddle, V. J. Carns, J. J. Vargo.

LOWRY, M. M., Partner, Lowry & Sorensen, Engrs., Phoenix. REFERENCES: W. A. Biddle, V. J. Carns, Ralph Hauer*, Alfred Maggs*.

California

BRINER, L. L., Estimator, Fiberglas Engineering & Supply Co., Sacramento. REFERENCES: C. W. Glasgow*, W. D. Kunz, M. B. Quillen, E. W. Wilson*.

LAKS, MAURICE, Mech. Engr., Luppen and Hawley, Inc., Sacramento. REFERENCES: M. J. Delavan, W. J. Edinger, E. B. Green, J. E. Marshall.

△MCCANN, R. J., Owner, R. J. McCann, Cons. Engr., Culver City. REFERENCES: K. A. Bowman, J. A. Knowles, A. Z. Levine, E. J. Schryver.

OPTICAN, A. W., Secy.-Treas., Arctic Sales & Service Heating, Ventilating & Air Conditioning, Hollywood. REFERENCES: L. B. Davenport, Norman Jacobs*, R. A. Lowe, A. E. Randhler*.

STEELE, E. D., Owner, Edward Steele Plumbing Co., Marysville. REFERENCES: F. M. Booth, J. R. Deterding*, Charles Keene*, L. A. O'Meara.

ZIEGLER, J. E., Technical Advisor, Revere Copper and Brass Inc., Los Angeles. REFERENCES: L. J. La Tart, W. L. Lynch, D. L. Mills, W. C. Voss.

Colorado

BECKETT, M. D., Design Engr., Len E. Rollins & Assocs., Denver. REFERENCES: R. G. Look, L. D. Niblack, L. E. Rollins*, H. L. Wray.

MITCHELL, S. P., Industrial Gas Engr., Public Service Co. of Colorado, Denver. REFERENCES: F. L. Adams, J. P. Dresen*, Fred Janssen, B. H. Spurlock, Jr.

Connecticut

AMBRISCOE, F. B., Master Heating Engr., A. B. Fuel Service, Milford. REFERENCES: Arnold Alderman*, R. J. Duckwall*, S. J. Horton*, E. J. Temple*.

△HOAGLAND, E. J., Branch Mgr., Johnson Service Co., Hartford. REFERENCES: C. L. L'Hommedieu, G. F. Nieske, R. B. Sweet, Carl Wahnquist, Jr.

Georgia

MARTIN, J. A., Sales Engr., Carrier Atlanta Corp., Atlanta. REFERENCES: L. L. Barnes, J. G. Croley, C. F. Hampton, S. N. Roberts.

PATRICK, J. B., Engr., Carrier Atlanta Corp., Atlanta. REFERENCES: L. L. Barnes, J. G. Croley, C. F. Daugherty, Jr., C. F. Hampton.

RAINEY, A. E., Engr., Carrier Atlanta Corp., Atlanta. REFERENCES: L. L. Barnes, J. G. Croley, C. F. Daugherty, Jr., S. N. Roberts.

RICHARDSON, W. B., Engr., Carrier Atlanta Corp., Atlanta. REFERENCES: L. L. Barnes, J. G. Croley, C. F. Daugherty, Jr., C. F. Hampton.

Illinois

DE COUDRES, D. A., Sales Engr., Bornquist Inc., Chicago. REFERENCES: G. W. Bornquist, Frank Gall, H. A. Lockhart, R. O. Nelson.

†GRAHAM, R. L., Br. Mgr., American Blower Corp., Rock Island. REFERENCES: C. Z. Adams, S. R. Allen, E. S. DeWitt, H. H. Hill.

△LE COMTE, A. J., Vice Pres., Kroeschell Engrg. Co., Chicago. REFERENCES: W. F. Christmann. N. A. Gregornik, G. D. Haberer, C. H. Kroeschell*.

MINDAK, R. J., Assoc. Engr., Armour Research Foundation, Chicago. REFERENCES: B. H. Jennings, J. C. Lee, E. F. Obert*, E. R. Teske.

WOLOFSKY, J. P., Graduate Student, University of Illinois, Urbana. REFERENCES: J. R. Fellows, W. S. Harris, S. Konzo, L. M. Zubko*.

Kansas

ANDERSON, A. M., Supt., D & D Sheet Metal & Air Cond., Inc., Overland Park. REFERENCES: F. J. Dean, Jr., N. G. Humphreys, W. J. O. Wagner, G. D. Yeazel.

WILLIAMS, D. D., Engr., S. A. Long Co., Inc., Wichita. REFERENCES: L. D. Baker, Jr., D. J. Gudeman, R. R. Irwin*, Grady Randle*.

Louisiana

DAVILA, G. W., Chief Engr., Industries Engineering Corp., New Orleans. REFERENCES: C. V. Bankston, H. E. Faller, R. K. Goode, E. O. Thoman.

NEWLIN, R. E., Air Cond. & Refrig. Engr., A. M. Lockett & Co., Ltd., New Orleans. REFERENCES: C. B. Gamble, W. G. Moses, A. R. Salzer, Jr., E. H. Sanford.

VIEAGES, G. A., Repr., Reilly Benton Co., Inc., New Orleans. REFERENCES: R. B. Guest, J. E. Leininger, A. F. Lusch, E. H. Sanford.

WITCHER, C. S., Engr., A. M. Lockett Co., Ltd., New Orleans. REFERENCES: H. L. Flettrich, W. P. Hindelang, Jr., W. C. Murphy III, E. H. Sanford.

YOUNG, J. C., Utilization Engr., New Orleans Public Service, Inc., New Orleans. REFERENCES: J. S. Burke, C. B. Gamble, G. E. May, H. L. Salaun.

Maryland

MCKAY, W. J., Engr., American Air Filter Co., Inc., Herman Nelson Div., Baltimore. REFERENCES: G. M. Heslop, W. W. Hill, W. G. Maynard, E. J. Morris.

STUCKI, A. C., Engr., National Institute of Health, Bethesda. REFERENCES: A. H. Bahnson, H. R. Iverson, G. R. Morgan, H. E. Rex.

Massachusetts

†FOULDS, S. T. N., Owner and Mgr., Foulds Associates, Boston. REFERENCES: D. W. Blair, L. R. Geissenhainer, G. W. Sprague, W. A. Williams.

Michigan

BARTMES, RUSSELL, JR., Br. Mgr., General Controls Co., Detroit. REFERENCES:

Robert Boehm*, Walt Kimberley*, W. M. Lewis, F. E. Weldon*.

EVANS, RONALD, Partner, Geisler Company, Dearborn. REFERENCES: G. J. Andrews, H. M. Armstrong, R. L. Deppmann, E. A. Weaver.

RUPPMAN, E. L., Engr., Johnson Service Co., Ferndale. REFERENCES: J. L. Best, P. S. Hosman, Axel Marin, P. H. Ziel.

Minnesota

ANDREWS, J. R., Repr., The Gorgen Co., Minneapolis. REFERENCES: J. A. Craig, B. F. McLouth, H. G. Sierk, W. A. Swenberg.

HENSCHEL, R. L., Repr., The Gorgen Co., Minneapolis. REFERENCES: J. A. Craig, B. F. McLouth, H. G. Sierk, W. A. Swenberg.

McGOUGH, J. H., Graduate Student, University of Minnesota, Minneapolis. REFERENCES: A. B. Algren, R. C. Jordan, D. J. Sutton, J. L. Threlkeld.

PIETTE, H. F., Design Engr., Gausman & Moore, St. Paul. REFERENCES: C. E. Gausman, G. M. Kendrick, William McNamara, William Sturm.

SORENSON, R. E., Engr., McQuay Inc., Minneapolis. REFERENCES: R. J. Resch, R. G. Strutzel, William Sturm, K. O. Werwath.

Missouri

LUCAS, E. B., Study Engr., Great Lakes Pipe Line Co., Kansas City. REFERENCES: D. M. Allen, C. D. Jones, P. C. Leffel, P. A. Moreno.

TURNER, J. E., Mech. Engr., Dan R. Sandford & Sons, Archts., Kansas City. REFERENCES: L. P. Heaven, Walter Hickman*, M. K. Rush, M. T. Sandford*.

WALSH, R. J., Estimator, D. M. Allen Co., Kansas City. REFERENCES: D. M. Allen, C. A. L. Davis, P. A. Moreno, E. L. Parker.

New Jersey

MOL, ALBERT, Engr., Barber-Colman Co., Irvington. REFERENCES: H. O. Bips, R. B. Darling, J. J. Devlin, P. H. Werner.

New York

△DUFFY, W. E., Engr., Morrison Steel Products Inc., Buffalo. REFERENCES: George Boeddener, A. J. Harsch*, Arthur Ritter, Jack Searls*.

△DUTCHER, H. S., Engr., Air & Refrigeration Corp., New York. REFERENCES: John Everetts, Jr., W. L. Fleisher, A. J. Hess, K. H. Norby.

FISHER, P. W., Partner, Olesko & Fisher, Rensselaer. REFERENCES: L. V. Appleby, D. A. Carofano, J. L. Ehretsman*, J. N. Futia.

GRAHAM, J. B., Research Engr., Buffalo Forge Co., Buffalo. REFERENCES: C. C. Cheyney*, John Everetts, Jr., R. D. Madison, R. J. Walker.

LUSCIER, EDWARD, Design and Installation of Air Conditioning Systems, Cohoes. REFERENCES: E. C. Doyle, F. R. Foote, Harry Horowitz, H. F. Kruger.

△MOYER, E. L., Partner, Malcolm B. and Edwin L. Moyer, Consulting Engrs., Syracuse. REFERENCES: F. E. Krell, H. K. Ormsby, K. T. Sprague, H. G. Strong.

OLESKO, T. S., Partner, Olesko & Fisher, Rensselaer. REFERENCES: L. V. Appleby, D. A. Carofano, R. F. Connell, J. N. Futia.

PHILBIN, J. M., Construction Engr., Universal Atlas Cement Co., New York. REFERENCES: F. A. Muller*, H. P. Reid, C. D. Rugen*, R. L. Walsh*.

SAMUELS, A. S., Supervisor, Walter Kidde Constructors, Inc., New York. REFERENCES: A. L. Crichton, Ernst Graber, Paul Hutchins, H. S. Johnson.

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WILLIAM C. McNEILL
Oklahoma City, Okla.

It was with deep regret that the Society learned of the passing of William C. McNeill on December 2, following a year of illness.

Mr. McNeill was born on December 25, 1893 at Fairfield, Tex., and attended school in Oklahoma. He began his professional career in 1919 as a designing mechanical engineer with the Board of Education, Akron, Ohio, joining William B. Ittner, Inc., St. Louis in 1926. He became associated with the Board of Education in St. Louis in 1929 and remained there until 1936. In the years that followed he served in a mechanical engineering capacity for the following companies: W. C. Roads, Tulsa; Public Works Administration, Oklahoma City; I. G. Howlett Co., Oklahoma City; the Austin Co., Oklahoma City; C. Wallace Plumbing Co., Dallas; Douglas Aircraft Co., Oklahoma City; Hudgins, Thompson, Ball & Assoc., Oklahoma City; and Sorey, Hill & Sorey, Oklahoma City. At the time of his death Mr. McNeill was a designing mechanical engineer with Collins & Gould, a consulting engineering firm of Oklahoma City.

Mr. McNeill, who joined the Society in 1951, was a registered professional engineer in the state of Oklahoma.

The Officers and Council of ASHVE extend their sincere sympathy to Mr. McNeill's widow, Alyce, now residing at 1225 South Denver, Tulsa, to his mother, and to his four brothers.

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International Joint Committee on Psychrometric Data: C. O. Mackey, Ithaca, N. Y., Chairman; B. A. Dmitrieff, New York, N. Y., Secretary; H. H. Bruce, London; G. A. Bull, London; C. S. Cragoe, Washington, D. C.; John A. Goff, Philadelphia; L. P. Harrison, Washington, D. C.; T. J. G. Henry, Toronto; B. H. Jennings, Evanston, Ill.; F. G. Keyes, Cambridge, Mass.; R. F. Legget, Ottawa; S. G. Rison, Washington, D. C.; P. A. Sheppard, London; J. L. York, Ann Arbor, Mich.

Joint Committee for Revision of Code of Minimum Requirements for Comfort Air Conditioning: W. L. Fleisher, Chairman; (ASHVE) O. W. Armspach, A. C. Buensod, C. C. Cheyney; (ASME) C. F. Kayan; (ASRE) F. H. Faust, C. F. Holske, J. A. Schurman; (ARI) M. M. Lawler, R. A. Gonzalez; Alternate: J. R. Schreiner; (U.S. Public Health Service) W. C. Cooper, M.D.; At Large: M. K. Fahnestock, P. J. Marschall, G. E. May, A. B. Newton; (Medical Profession) R. W. Keeton, M.D., W. J. McConnell, M.D.

Long-Range Planning Committee: J. E. Haines, Chairman; P. B. Gordon, A. J. Hess, John W. James, J. D. Kroeker, L. E. Seeley.

ASHVE — OFFICERS OF CHAPTERS AND BRANCHES

(55 Chapters: 1 Special Branch: 9 Student Branches)

Date indicates year organized; an address and no city shown signifies same city as headquarters; numeral in parentheses indicates zone.

● **ARIZONA:** 1953. Hdqrs., Phoenix, Ariz. PRESIDENT, V. J. Carns, 3602 No. 15th Dr. SECRETARY, A. J. Nelesen, Jr., 6744 No. 14th Pl.

● **ARKANSAS:** 1952. Hdqrs., Little Rock, Ark. Meets, Third Tuesday. PRESIDENT, R. E. Blaylock, 509 E. Markham St. SECRETARY, J. L. Brown, 212 Terminal Warehouse Bldg.

● **ATLANTA:** 1937. Hdqrs., Atlanta, Ga. Meets, Second Monday. PRESIDENT, J. G. Croley, 400 Batavia St., East Point, Ga. SECRETARY, T. A. Barrow, 157 Simpson St., N.W.

● **BALTIMORE:** 1949. Hdqrs., Baltimore, Md. Meets, Third Wednesday. PRESIDENT, H. D. Glaser, Federal Land Bank Bldg., 2315 St. Paul St. (18). SECRETARY, G. J. Senner, 6010 Edmondson Ave. (28).

● **BRITISH COLUMBIA:** 1952. Hdqrs., Vancouver, B.C., Canada. Meets, Second Wednesday. PRESIDENT, C. W. Leek, 1155 West 49th Ave. SECRETARY, D. A. English, 6412 Adera St.

● **CENTRAL NEW YORK:** 1944. Hdqrs., Syracuse, N. Y. Meets, Fourth Wednesday. PRESIDENT, C. R. Acheson, 306 W. Genesee St. SECRETARY, H. K. Ormsby, 205 S. Townsend St. (2).

● **CENTRAL OHIO:** 1944. Hdqrs., Columbus, Ohio. Meets, Third Monday. PRESIDENT, N. T. Hess, 63 E. Goodale St. SECRETARY, R. A. Wilson, 20 S. Third St., (15).

● **CINCINNATI:** 1932. Hdqrs., Cincinnati, Ohio. Meets, First Tuesday. PRESIDENT, R. C. Beineke, 626 Broadway, (2). SECRETARY, A. H. Gerdsen, 224 E. Second St., (2).

● **CONNECTICUT:** 1940. Hdqrs., New Haven, Conn. Meets, Third Thursday. PRESIDENT, G. F. Nieske, 165 Maple St., Naugatuck. SECRETARY, E. J. Hoagland, 257 S. Whitney St., Hartford.

● **DELTA:** 1939. Hdqrs., New Orleans, La. Meets, Third Tuesday. PRESIDENT, H. L. Salaun, 317 Baronne St. SECRETARY, T. J. Jenny, 1000 S. Peters St., (9).

● **EMPIRE STATE CAPITAL:** 1951. Hdqrs., Albany, N. Y. Meets, Second Wednesday. PRESIDENT, N. W. Burrill, 33 Riverside Ave., Rensselaer. SECRETARY, L. V. Appleby, 373 State St.

● **GOLDEN GATE:** 1937. Hdqrs., San Francisco, Calif. Meets, First Thursday. PRESIDENT, J. E. Murray, 350 Mission St. (5). SECRETARY, D. E. McLeod, 105 San Pablo Ave. (27).

● **ILLINOIS:** 1906. Hdqrs., Chicago, Ill. Meets, Second Monday. PRESIDENT, H. G. Chapin, 185 N. Wabash Ave., (1). SECRETARY, H. G. Gragg, Rm. 1310, 228 N. LaSalle St. (1).

● **INDIANA:** 1943. Hdqrs., Indianapolis, Ind. Meets, Fourth Tuesday. PRESIDENT, R. C. Blackman, 5505 N. Illinois St., (8). SECRETARY, J. W. Jackson, 3514 N. Drexel, (18).

● **INLAND EMPIRE:** 1950. Hdqrs., Spokane, Wash. Meets, First Friday after First Tuesday. PRESIDENT, G. M. Dieter, 917 W. Mallon. SECRETARY, F. W. Jenkinson, N. 1904 Smith St., (15).

● **IOWA:** 1940. Hdqrs., Des Moines, Ia. Meets, Second Tuesday. PRESIDENT, J. F. Sandfort, Iowa State College, Ames. SECRETARY, G. J. Kraai, 907 Sixth Ave. (14).

● **KANSAS:** 1951. Hdqrs., Wichita, Kan. Meets, Tuesday after First Monday. PRESIDENT, R. L. Pennington, 520 So. Commerce (2). SECRETARY, O. B. Strahm, 601 So. Terrace Dr.

● **KANSAS CITY:** 1917. Hdqrs., Kansas City, Mo. Meets, First Monday. PRESIDENT, G. H. Stoffer, 200 Riss Building (6). SECRETARY, A. S. Hurt, Jr., 2119 Washington St., (8).

● **MANITOBA:** 1935. Hdqrs., Winnipeg, Man., Canada. Meets, Fourth Thursday. PRESIDENT, A. K. Piercy, 222 Osborne St. N. SECRETARY, D. B. Brace, 1550 Dublin Ave.

● **MASSACHUSETTS:** 1912. Hdqrs., Boston, Mass. Meets, Third Tuesday. PRESIDENT, A. L. Hare, 127 Federal St. (10). SECRETARY, W. G. Martin, Jr., 20 Winchester St. (16).

● **MEMPHIS:** 1944. Hdqrs., Memphis, Tenn. Meets, Third Monday. PRESIDENT, A. W. Shelby, 972 Union Ave. SECRETARY, A. T. Bevil, 1638 Union Ave. (4).

● **MIAMI VALLEY:** 1950. Hdqrs., Dayton, Ohio. Meets, First Wednesday. PRESIDENT, John Schweiger, 593 Acorn Drive, Dayton (9). SECRETARY, D. E. Tullis, 743 Kiser St. (4).

● **MICHIGAN:** 1916. Hdqrs., Detroit, Mich. Meets, First Monday after 10th of month. PRESIDENT, R. H. Oberschulte, 316 McKerchey Building, (1). SECRETARY, D. S. Falk, 4864 Woodward Ave. (1).

● **MINNESOTA:** 1918. Hdqrs., Minneapolis, Minn. Meets, First Monday. PRESIDENT, V. E. Pearson, 739 Marquette Ave. (2). SECRETARY, E. T. Erickson, 500 Baker Arcade.

● **MISSISSIPPI:** 1953. Hdqrs., Jackson, Miss. PRESIDENT, I. E. Rowe, 120 Georgia St. SECRETARY, M. E. Price, 205 Arbor Hill Dr.

● **MONTREAL:** 1936. Hdqrs., Montreal, Que., Canada. Meets, Third Monday. PRESIDENT, B. J. Horsburgh, 940 Ogilvy Ave. (15). SECRETARY, R. J. Ker, 1000 Beaver Hall Hill, P. O. Box 340.

● **NEBRASKA:** 1940. Hdqrs., Omaha, Neb. Meets, Second Tuesday. PRESIDENT, O. J. Smith, 233 Grain Exchange Bldg., (2). SECRETARY, C. A. Failor, 5736 N. 33rd St. (11).

● **NEW YORK:** 1911. Hdqrs., New York, N. Y. Meets, Third Monday. PRESIDENT, J. E. Schechter, 32-08 38th Ave., Long Island City (1). SECRETARY, Carl H. Flink, 62 Worth St. (13).

● **NORTH JERSEY:** 1952. Hdqrs., Newark, N. J. Meets, Second Tuesday. PRESIDENT, F. H. Faust, 5 Lawrence St., Bloomfield. SECRETARY, C. H. Smith, 2490 Vreeland Mills Rd., Linden.

● **NORTH TEXAS:** 1938. Hdqrs., Dallas, Tex. Meets, Third Monday. PRESIDENT, M. W. Brown, 1213 Texas Bank Bldg. SECRETARY, H. G. Gregerson, 2921 Fairmount.

● **NORTHEASTERN OKLAHOMA:** 1948. Hdqrs., Tulsa, Okla. Meets, Second Tuesday. PRESIDENT, J. N. Watt, 528 E. Fifth. SECRETARY, J. C. Netherton, Jr., 3130 E. 44th St.

● **NORTHERN OHIO:** 1916. Hdqrs. Cleveland, Ohio. Meets, Second Monday. PRESIDENT, J. M. Black, 1296 Gordon Rd., Lyndhurst. SECRETARY, Sherwood Nassau, 6014 Euclid Ave.

● **NORTHERN PIEDMONT:** 1952. Hdqrs., Greensboro, N.C. Meets, Second or Third Friday. PRESIDENT, R. B. Crosland, Jr., 1001 S. Marshall St., Winston-Salem. SECRETARY, W. H. Cooper, 1001 S. Marshall St., Winston-Salem.

● **OKLAHOMA:** 1935. Hdqrs., Oklahoma City, Okla. Meets, Second Monday. PRESIDENT, F. X. Loeffler, Jr., Box 529. SECRETARY, G. E. Ervin, 2800 N. Oklahoma St. (5).

● **ONTARIO:** 1922. Hdqrs., Toronto, Ont., Canada. Meets, First Monday. PRESIDENT, N. W. Kingsland, 31 Willcocks St. SECRETARY, H. R. Roth, 57 Bloor St., W.

● **OREGON:** 1939. Hdqrs., Portland, Ore. Meets, Thursday after First Tuesday. PRESIDENT, A. N. Hoss, 621 S.W. Alder (5). SECRETARY, J. E. Finkbeiner, 10260 S.W. Daphne Pl. (1).

● **OTTAWA VALLEY:** 1952. Hdqrs., Ottawa, Ont., Canada. Meets, Third Tuesday. PRESIDENT, G. L. Ostiguy, 282 Westhill Ave. (3). SECRETARY, N. J. Howes, Box 264, R. R. 1.

● **PACIFIC NORTHWEST:** 1928. Hdqrs., Seattle, Wash. Meets, Second Tuesday. PRESIDENT, H. T. Orebaugh, 1330 Dearborn. SECRETARY, L. F. Christofferson, 7358-58th Ave. N.E., (5).

● **PHILADELPHIA:** 1916. Hdqrs., Philadelphia, Pa. Meets, Second Thursday. PRESIDENT, C. F. Dietz, 3449 W. Indiana Ave. (32). SECRETARY, P. H. Yeomans, Architects Building (3).

● **PITTSBURGH:** 1919. Hdqrs., Pittsburgh, Pa. Meets, Third Monday. PRESIDENT, C. H. Schneider, 310 Washington Rd. SECRETARY, E. H. Riesmeyer, Jr., 231-33 Water St. (22).

● **ROCKY MOUNTAIN:** 1944. Hdqrs., Denver, Colo. Meets, First Wednesday. PRESIDENT, H. L. Wray, 1101 Geneva St., Aurora. SECRETARY, J. F. Cipra, Jr., 2676 S. Madison St.

● **SACRAMENTO VALLEY:** 1952. Hdqrs., Sacramento, Calif. Meets, First Wednesday. PRESIDENT, E. C. McKinsey, 4220 Annette (21). SECRETARY, R. A. Sarro, 5412 Argo Way.

● **ST. LOUIS:** 1918. Hdqrs., St. Louis, Mo. Meets, Second Tuesday. PRESIDENT, H. C. Sharp, 4060 W. Pine Blvd. (8). SECRETARY, W. P. Norris, 1118 Fullerton Bldg.

● **SHREVEPORT:** 1948. Hdqrs., Shreveport, La. Meets, Third Thursday. PRESIDENT, M. A. Hudson, 753 Gladstone Blvd. SECRETARY, R. S. Segall, 603 Cotton St.

● **SOUTH TEXAS:** 1938. Hdqrs., Houston, Tex. Meets, Third Friday. PRESIDENT, E. G. Floeter, Jr., P.O. Box 1657 (1). SECRETARY, F. M. Neil, 3513 W. Dallas Ave. (19).

● **SOUTHERN CALIFORNIA:** 1930. Hdqrs., Los Angeles, Calif. Meets, First Tuesday. PRESIDENT, L. B. Davenport, 137 S. Anderson St. (33). SECRETARY, J. L. McCullough, 1978 S. Los Angeles St. (11).

● **SOUTHERN PIEDMONT:** 1952. Hdqrs., Charlotte, N.C. PRESIDENT, R. E. Mason, 1726 Hutchinson Ave. (1). SECRETARY, S. B. Blanton, Box 6096.

● **SOUTHWEST TEXAS:** 1946. Hdqrs., San Antonio, Tex. Meets, Third Tuesday. PRESIDENT, L. H. Hornor, Jr., 816 Insurance Bldg. SECRETARY, Boone Crisp, P.O. Box 9065, (4).

● **UTAH:** 1944. Hdqrs., Salt Lake City, Utah. Meets, Third Thursday. PRESIDENT, M. L. Gollaher, 1163 Roosevelt Ave. (5). SECRETARY, G. L. Soderborg, Sr., 42 E. 8th St. S.

● **VIRGINIA:** 1946. Hdqrs., Norfolk, Va. Meets, Third Wednesday. PRESIDENT, E. D. Duval, 1023 Hanover Ave. SECRETARY, T. B. Carpenter, 412 Chester St.

● **WASHINGTON, D. C.** 1935. Hdqrs., Washington, D. C. Meets, Second Wednesday. PRESIDENT, J. G. Muirheid, Bureau of Ships, Navy Dept. (25). SECRETARY, W. C. Reamy, Jr., 17th & Pennsylvania Ave., N. W. (6).

● **WEST TEXAS:** 1953. Hdqrs., Lubbock, Tex. PRESIDENT, R. A. Mixon, 227 Whiteside Bldg. SECRETARY, R. B. Carow, 3721 31st St.

● **WESTERN MICHIGAN:** 1931. Hdqrs., Grand Rapids, Mich. Meets, Second Monday. PRESIDENT, J. T. Anderson, Michigan State College, East Lansing. SECRETARY, N. A. Buckley, 514 Park Rd., Jackson.

● **WESTERN NEW YORK:** 1919. Hdqrs., Buffalo, N. Y. Meets, Second Monday. PRESIDENT, C. W. Stone, 1219 Main St. (9). SECRETARY, C. W. Kaupp, 271 Delaware Ave.

● **WISCONSIN:** 1922. Hdqrs., Milwaukee, Wis. Meets, Third Monday. PRESIDENT, N. E. Hill, 122 N. Hartwell Ave., Waukesha. SECRETARY, K. H. Forfar, 2711 N. 27th St. (10).

SPECIAL BRANCH

● **SWISS:** 1952. Hdqrs., Zurich, Switzerland. PRESIDENT, Leo de Bruyn, Muhlebachstr, 172, Zurich. SECRETARY, Walter Hausler, Erbstrasse 2, Kusnacht, Zurich.

STUDENT BRANCHES

● **NORTH CAROLINA STATE COLLEGE:** 1948. Hdqrs., Raleigh, N. C. PRESIDENT, Norman Falbaum, Box 4668, State College Station. SECRETARY, J. L. Flowers, Apt. 33-E, Vetville.

● **OKLAHOMA A. & M. COLLEGE:** 1950. Hdqrs., Stillwater, Okla. PRESIDENT, C. E. Durrett, 1215 College. SECRETARY, R. M. Jauch, 308½ W. Maple.

● **OREGON STATE COLLEGE:** 1949. Hdqrs., Corvallis, Ore. Meets, First Wednesday after First Tuesday. PRESIDENT, R. E. Bulletset, 252 Kings Rd. SECRETARY, I. P. Parkhurst, 1354 Harrison.

● **PURDUE UNIVERSITY:** 1948. Hdqrs., W. Lafayette, Ind.

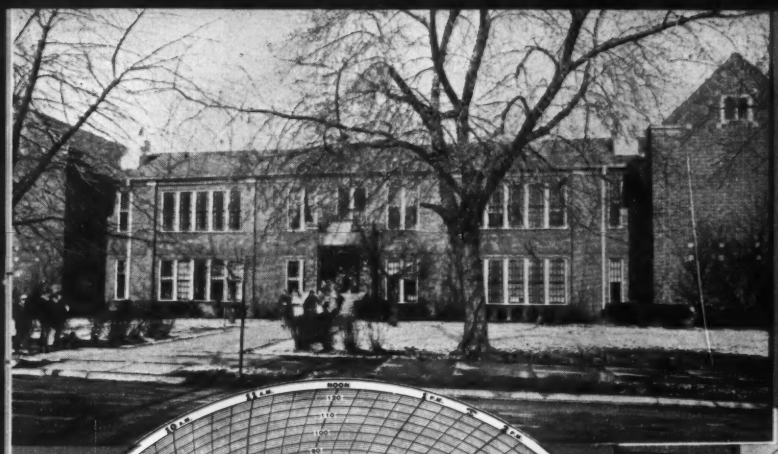
● **TEXAS A. & M. COLLEGE:** 1946. Hdqrs., College Station, Tex. Meets, Second and Fourth Tuesday. PRESIDENT, D. F. Carroll, Box 6264. SECRETARY, C. W. Farrar, Jr., Rt. 1, Box 339, Bryan.

● **UNIVERSITY OF DETROIT:** 1949. Hdqrs., Detroit, Mich. Meets, First Tuesday. PRESIDENT, J. R. Cairns, 4001 Florence, (21). SECRETARY, W. E. Zimmerman, 15359 Lauder (27).

● **UNIVERSITY OF KANSAS:** 1949. Hdqrs., Lawrence, Kans. Address mail to Dr. Warren E. Snyder, chairman, Dept. of Mechanical Engineering, University of Kansas.

● **UNIVERSITY OF TEXAS:** 1949. Hdqrs., Austin, Tex. Meets, First and Third Tuesday.

● **UNIVERSITY OF TORONTO:** 1951. Hdqrs., Toronto, Ont. CHAIRMAN, Alexander Tudor, 75 South Dr. SECRETARY, T. M. Devine, More House, St. Michaels College.

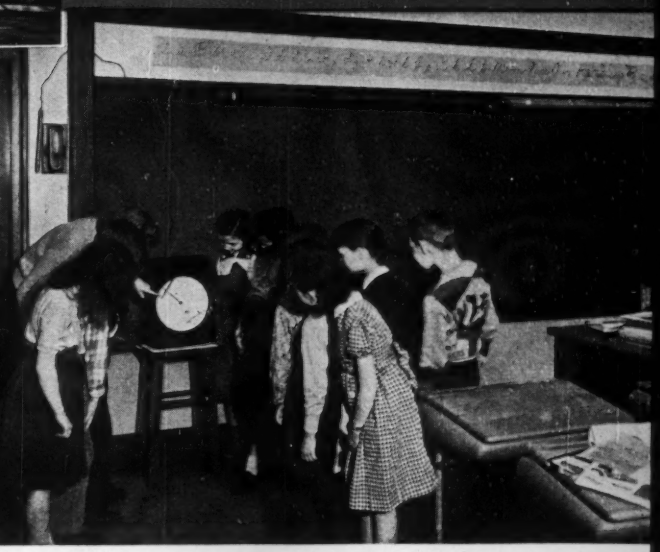


IN 1924 the **BANTA SCHOOL**
In Valparaiso, Indiana was equipped with

POWERS

Pneumatic System of
TEMPERATURE CONTROL

Chief Engineer Mr. Joseph Kutscheid setting up a Recording Thermometer in one of the rooms in the Banta School, Valparaiso, Ind. Thermostats were set for 75° F.



Miss Chelf, teacher and pupils in fourth grade inspecting Recording Thermometer chart record shown at left. Powers Type K Thermostat was set for 75° F. Note even control during school hours.

After 29 Years Charts like those shown at left.

Will the Temperature Control System you are buying today give as good regulation as this when it is 29 years old?

Again and again 25 to 50 year old POWERS pneumatic systems of temperature control pass recording thermometer tests with high marks.

Why make a major investment in a control system that has no proven record for long life, low operating and low maintenance cost? Get the most for your money. Install Powers.

Maintenance cost on this job was 11% of the installed price 29 years ago.

(b45)

THE POWERS REGULATOR COMPANY

SKOKIE, ILLINOIS

OFFICES IN OVER 50 CITIES IN U.S.A., CANADA, AND MEXICO • SEE YOUR PHONE BOOK

OVER 60 YEARS OF AUTOMATIC TEMPERATURE CONTROL

LOOK WHAT'S HAPPENING IN YOUR COOLING TOWER

HERE'S WHY KOPPERS PRESSURE CREOSOTING ON HALSTEAD & MITCHELL COOLING TOWERS IS VITAL FOR LONG LIFE

WHY CREOSOTED WOOD?

Rough-cut wood simply "wets" more effectively than any other suitable material. Constantly wetted wood is subject to immediate attack by fungus and marine parasites. Creosote is the most permanent and positive preservative for timber . . . *containing 162 elements* toxic to fungus growth and parasites . . . proved by over 100 years of use. All wood used in Halstead & Mitchell Cooling Towers is pressure-creosoted.

WHY KOPPERS PRESSURE-CREOSOTING?

Wood preservatives must penetrate deeply to be effective; a surface coating can be worn or broken through and the wood is then under immediate attack. Koppers Pressure-Creosoting gives the deepest possible penetration and longest possible life. Therefore, Halstead & Mitchell wetted decks are Koppers Pressure-Creosoted.

ONLY HALSTEAD & MITCHELL OFFERS THE

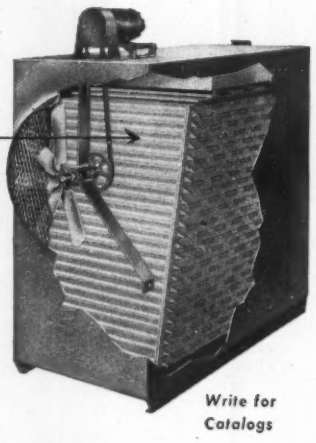
20-Year Guarantee!

ON THE WETTED DECK SURFACE

against rotting by fungus attack

2 thru 100 Tons

Sheet-Steel Cabinets,
3-times protected
Stainless Steel Fans and Shafts
Weather Shielding
Gravity-Type Distributing Pans
—no windage loss
Everdur Bolts for ease of
disassembly at any time.



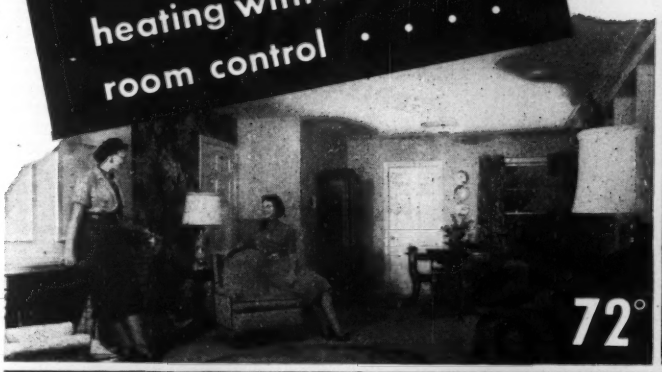
Write for Catalogs

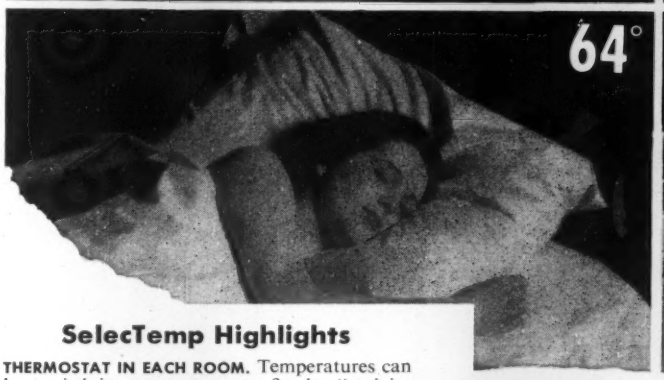
HM
Halstead & Mitchell

OFFICES: Bessemer Bldg., Pittsburgh 22, Pa.

At last... continuous modulated heating with individual room control . . . .

SelecTemp TRADE MARK HEATING





SelecTemp Highlights

THERMOSTAT IN EACH ROOM. Temperatures can be varied in every room to fit the "activity plan" and personal preference of the occupants.

MODULATED HEAT. Air circulation is continuous. Both temperature and volume of air is automatically modulated, as required to offset heat loss from room.

FILTERED, CIRCULATED AIR. Individual room air circulation prevents transmission of odors or bacteria from other rooms. Air is cleaned by a spun glass filter in each room unit. Filtered outside air can be introduced if desired.

BOILER LOCATION. Does not require centrally located heating plant. Boiler can be placed in any desired location, with proper distribution of heat to every room.

LOW POWER COST. No electricity required to operate circulating fans. Nonelectric thermostats.

LOW INITIAL COST. No other system can be so easily installed in either new or old construction. Small soft copper tubing (¼ inch I.D.) carries steam to individual room heater units. Return lines are ⅛ inch. Tremendous savings in installation costs.

LOW FUEL COST. Temperature easily reduced in unused rooms. Eliminates overheating.

AUTOMATICALLY BALANCED. No special adjustments of dampers, valves or orifices required to balance heating system. Each unit continuously regulates heat needed for each room. Automatically compensates for external heat sources such as fireplace or solar heat, without affecting temperatures of other rooms.

important announcement by Iron Fireman

Iron Fireman SelecTemp is a distinctively new method of comfort heating. It has been in actual use for three years and is giving outstanding performance in all types of buildings, from small homes to motels, apartment houses and office buildings.

Heating engineers have long recognized the need for accurately *modulated* heat (in contrast to the old "on-and-off" method of heat control), with individual room control. The modern trend toward extended floor plan and "picture" windows makes zone control essential for true heating comfort.

Until now, only those who could afford the very high cost of an elaborate heating plant and complex control system could enjoy a modulating flow of heat with control in *each room*.

Iron Fireman SelecTemp combines all of these desirable elements in such a simple and practical way that the ultimate in heating comfort can now be enjoyed in the smallest home or the largest residential, institutional or commercial building. Ideal for both new construction and modernization.

Write for descriptive booklet and specifications to Iron Fireman SelecTemp, 3151 W. 106th St., Cleveland 11, Ohio.

SelecTemp TRADE MARK

PRODUCT OF IRON FIREMAN

Send for full information

IRON FIREMAN MANUFACTURING CO.
3151 W. 106th Street, Cleveland 11, Ohio.
Please send literature on Iron Fireman SelecTemp heating.

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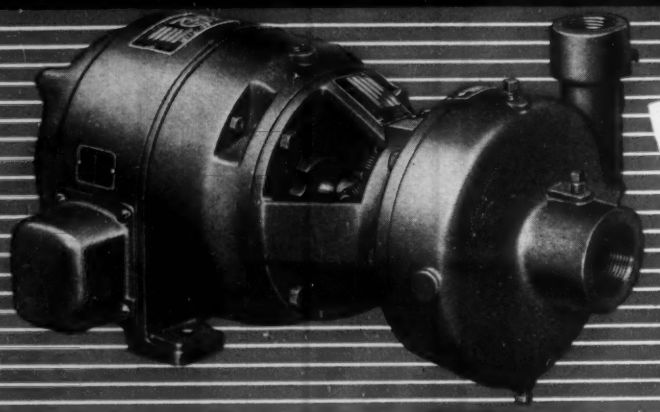
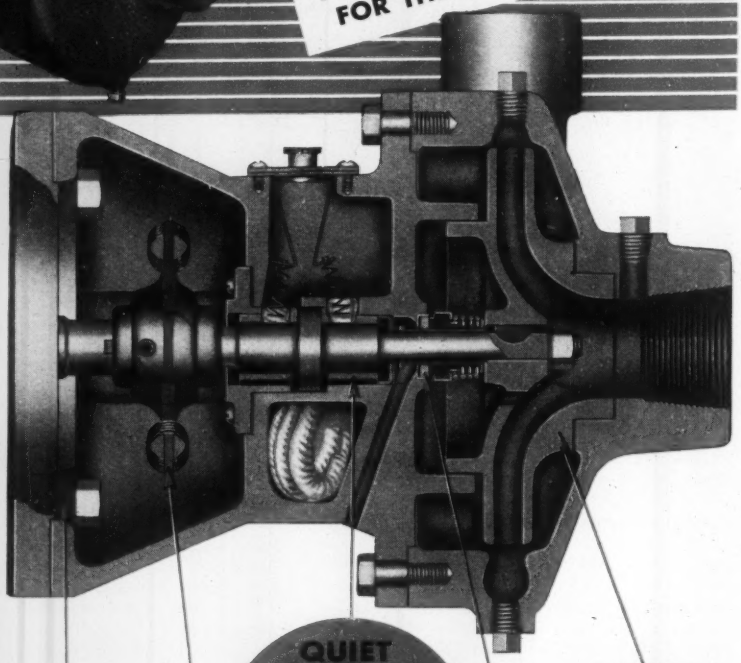
STOP PUMP NOISE!

IN COOLING TOWER AND OTHER REFRIGERATION APPLICATIONS



SERIES 1522 CENTRIFUGAL PUMPS ARE QUIETER THAN OTHER PUMPS USED FOR THE SAME PURPOSE


INTER-CHANGEABLE BEARING BRACKET
QUIET BRONZE SLEEVE BEAR-INGS IN BOTH PUMP AND MOTOR
IMPELLER DYNAMICALLY BALANCED
QUIET, SPRING-TYPE FLEXIBLE COUPLING
WATER-TIGHT "REMITE" MECHANICAL SEAL

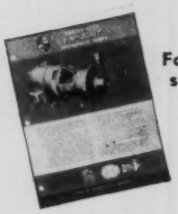
Where else CAN YOU FIND SO MANY EFFICIENCY FEATURES IN ONE PUMP

If you're having noise trouble (or any other kind) in your refrigeration and air conditioning installations, better switch now to the B & G Series 1522 Pump.

This pump is *really quiet*...because *both pump and motor* are equipped with long bronze sleeve bearings...and because of the noise-dampening flexible spring coupler.

The 1522 is alive with other features for dependable performance. Leakage is eliminated by the "Remite" Mechanical Seal, self-lubricating and harder than glass! The impeller is dynamically balanced—the bearing bracket subassembly, including shaft and sleeve bearing, is interchangeable. Easily serviced—the pump separates into three parts.

The B & G 1522 is available in all-iron, bronze-fitted, all-bronze or stainless steel units, capacities to 150 GPM —heads to 115 feet.



For complete data send for Bulletin FK-653

BELL & GOSSETT

C O M P A N Y

Dept. RDH-5, Morton Grove, Illinois

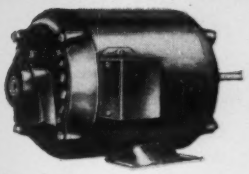
Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Drive, Toronto, Canada

for smooth, quiet performance that keeps customers happy

standardize on Century MOTORS

SINGLE PHASE:
Split Phase Induction—⅛, ¼, ⅓, H.P.
Capacitor—⅛ to 20 H.P.
Repulsion start, brush lifting,
Induction—½, to 7½ H.P.

For unit heaters, attic fans, furnace blowers, window fans, room coolers, circulating pumps, compressors.



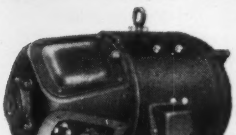
There's a Wide Range of Types and Sizes For All Your Needs

Century Motors are available in all types of protective frames, such as Splashproof for outdoor installations on cooling towers —and Explosion Proof for use in operating rooms where an explosive ether is present.

POLYPHASE:
Squirrel Cage Induction—⅛ to 400 H.P.
Wound Rotor Motors—1 to 400 H.P.
Synchronous Motors—20 to 150 H.P.

For compressors, fans, blowers, cooling towers, pumps.

For expert help with your motor problems, consult the Century Branch Office nearest you, or conveniently located Century distributor. A nation-wide network of Century Service Stations is always at your service to give the assistance you need.



DIRECT CURRENT:
⅛ to 300 H.P.

For all applications that require direct current.

GEAR MOTORS:
⅛ to 15 H.P., single, double and triple gear reduction.

Century C MOTORS

CENTURY ELECTRIC COMPANY
1809 PINE STREET • ST. LOUIS 3, MISSOURI
Offices and Stock Points In Principal Cities

826

only AAF makes the complete line

*AAF MULTI-DUTY—the above photo shows a rear view of part of a big installation which provides clean air for testing Jet Engines. This unit, the most widely used automatic air cleaner in the world, features overlapping panel construction.

The MULTI-DUTY's positive self-cleaning principle assures continuous operation with minimum maintenance. AAF manufactures four other types of viscous filters which utilize every known method of maintenance. And remember—AAF is the only complete line.

ELECTRO-MATIC

ELECTRO-CELL

ELECTRO-PL

ELECTRO-MIST

ELECTRO-KLEAN

AUTO-AIRMAT

AIRMAT PL-24

DEEP-PAK

DEEP BED

* * M/W-HV UNITS

DRIFILTER

* MULTI-DUTY

* RENU-GLAS

* AMER-GLAS

Why 5 types* of viscous air filters?

It's a good question! Since other companies only make *one* or *two* types! However the answer makes sense to engineers. AAF's five distinct types offer the needed latitude in specifying the right filter for a specific job without a compromise! Following are the five types of AAF viscous impingement filters:

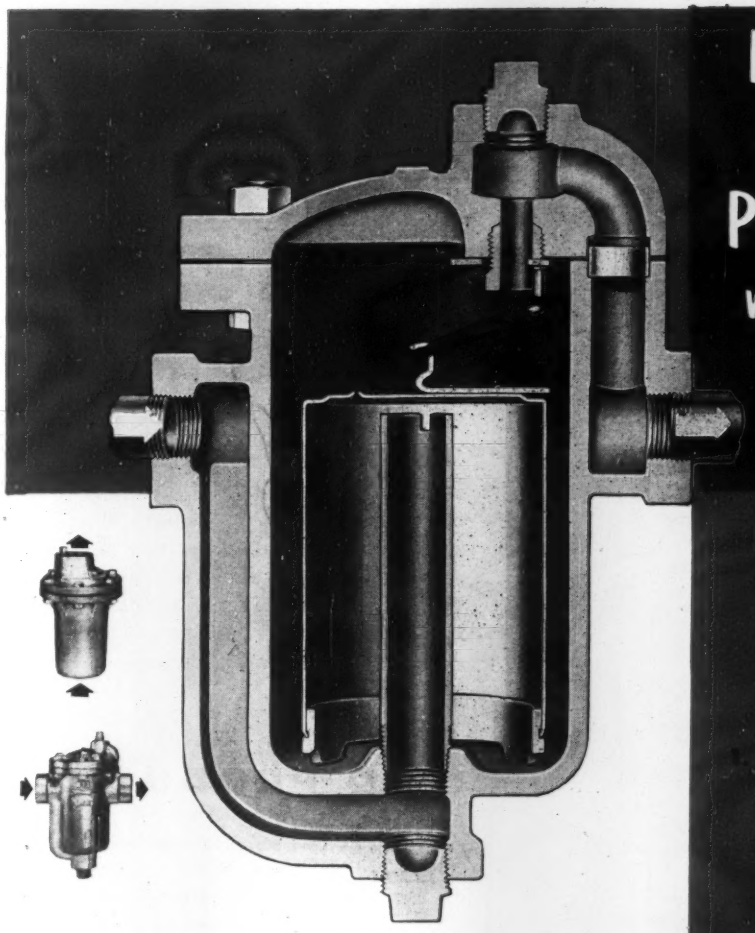
- MULTI-DUTY — permanent self-cleaning, fully automatic filter with exclusive overlapping panel construction.
- M/W Unit — washable filter for heavy industrial service.
- HV Unit—high velocity washable filter with exclusive media design for commercial and industrial applications.
- RENU-*glas* — low cost filter with replaceable glass filament pads enclosed in a permanent metal frame.
- AMER-*glas*—throw away filter with fine glass filament.

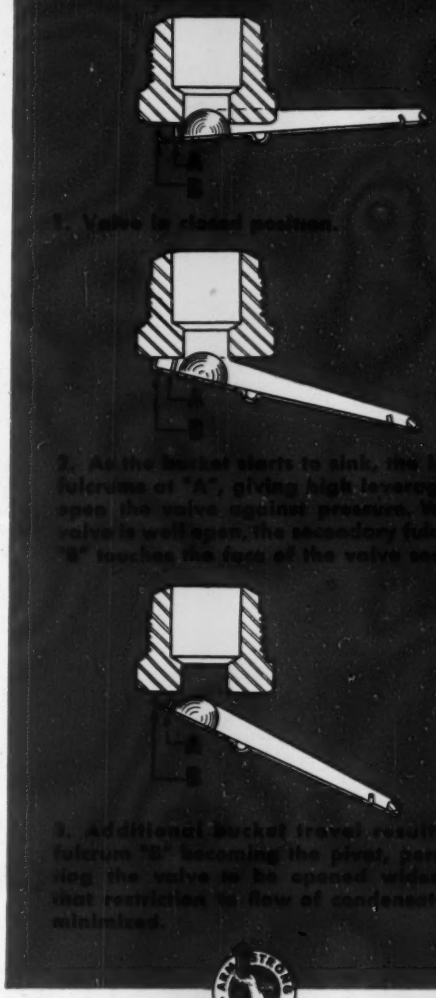
Our nation-wide Sales Engineering staff is at your disposal. Please write or wire . . . no obligation of course. Fully descriptive literature is also available.

American Air Filter
COMPANY, INC.

373 Central Avenue, Louisville 8, Ky.
American Air Filter of Canada, Ltd., Montreal, P. Q.

MORE TRAP CAPACITY PER DOLLAR with Armstrong two-phase leverage





Two-phase steam trap leverage is an original development by Armstrong and has been incorporated in Armstrong traps since the memory of most engineers runneth not to the contrary. It provides:

1. High initial leverage to open the valve against pressure.
2. Secondary lower leverage which permits the valve to travel well clear of the seat to minimize restriction to flow of condensate.

A single-phase lever can open just as large a valve *or* give just as great valve travel, *but not both.* Thus, Armstrong two-phase leverage gives very much greater capacity, depending on trap size than the earlier leverage system.

No steam trap gives greater actual hot condensate capacity, size for size, and dollar for dollar, than an Armstrong!

For complete data call your local Armstrong Representative or send for the 44-page Steam Trap Book.

ARMSTRONG MACHINE WORKS
874 Maple Street, Three Rivers, Michigan

ARMSTRONG STEAM TRAPS

the best running mate your product can have–

DELCO MOTORS

Every Delco motor, large or small, is engineered and built to assure the uninterrupted usefulness of the product it ultimately will serve. In the wide range of Delco fractional and integral motors, you can be sure that you will find the best running mate *your* product can have.

DELCO PRODUCTS

DIVISION OF
GENERAL MOTORS CORPORATION
DAYTON 1, OHIO

SALES OFFICES:
Atlanta • Chicago • Cincinnati
Cleveland • Dallas • Detroit • Hartford
Philadelphia • St. Louis • San Francisco

THIS SUPER Seal

(EXCLUSIVE IN SEALMASTER BEARINGS)

obsoletes old ideas on bearing maintenance cos

IT KEEPS dirt out AND grease in!

When dirt gets into bearings or grease leaks out, you've got trouble . . . high maintenance and replacement costs and all-too-frequent disassembly and downtime for machines.

Permanently Sealed SEALMASTER Bearings Were Developed to Lick This Problem

HERE'S WHY: In SEALMASTER Bearings, grooved, steel inner seals—permanently mounted on the outer race ring, one on each side, form the grease chamber.

Two annular felt-lined flingers rotating with the inner race ring and within the grooves of the inner seals, form the outer seals. The centrifugal action of these flingers effectively seals out all dirt. The bottom flanges of these rotating flingers, passing under and slightly beyond the inner seals, create a vortex action in the grease chamber. This breaks up the grease flow and retains just the right amount of grease to lubricate.

Whether your problem is dirt or simply making sure the bearings in the machines you make or use will give maximum service, SEALMASTER Bearings can help *you*. They are first class assurance of low maintenance costs and long bearing life! Write for Bulletin No. 845.

SEALMASTER

BALL BEARING UNITS

Cartridge Unit | Flange-Cartridge Unit | Flange Unit | Take-Up Unit | Pillow-Block Unit

SEALMASTER BEARINGS

47 Ridgeway Avenue, Aurora, Illinois

A DIVISION OF STEPHENS-ADAMSON MFG. COMPANY

FACTORY REPRESENTATIVES AND DEALERS IN ALL PRINCIPAL CITIES

with WALSEAL®

. . . and you can *see* that it's made right. When you make a WALSEAL joint the fillet of silver brazing alloy that appears at the face of the fitting is your assurance of full penetration and a permanently leak-proof joint that's vibration proof and corrosion-resistant . . . won't creep or pull apart under any conditions that the pipe itself can withstand.

Walseal is a registered trade-mark which identifies valves, flanges and fittings manufactured by the Walworth Company. Walseal products have *factory-inserted* rings of silver brazing alloy in threadless ports. Joints made with Walseal products are silver brazed and actually make the system a "one-piece pipeline."

Your copy of Circular 115 giving details on Walseal valves and fittings will be sent on request . . . send for it or see your nearby Walworth distributor.

SEE OUR CATALOG IN SWEET'S

Make it a "one-piece pipeline" with Walseal

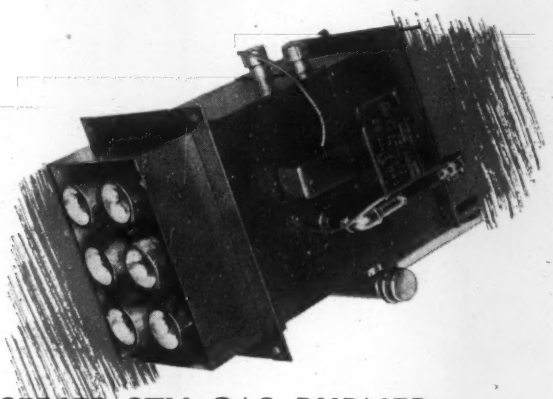
WALWORTH

valves and fittings

60 EAST 42nd STREET NEW YORK 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

JOHN ZINK JZ BURNERS *for All* HEATING *and* POWER NEEDS

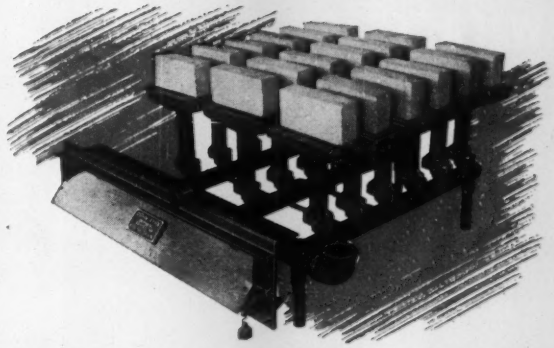


SERIES STV GAS BURNER

4" to 2#

Ideal for heating boiler installations. From one head to fifty heads. Quiet, efficient and economical operation.

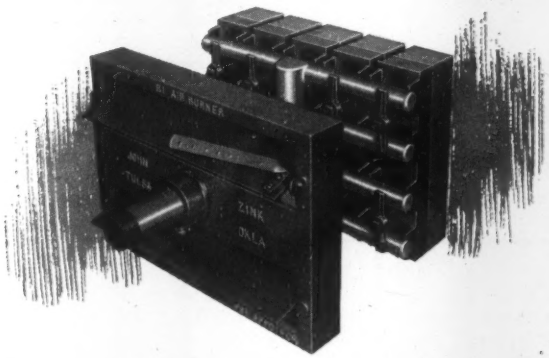
Write for literature.



SERIES VR VERTICAL GAS BURNER

4" to 4 oz.

This burner is one of the "upshots" or vertical radiant type with multiple burner heads so designed as to entrain a certain amount of primary air from the total air entering through the louvre. The "VR" burners are especially designed to operate in boilers having low draft and small combustion space.

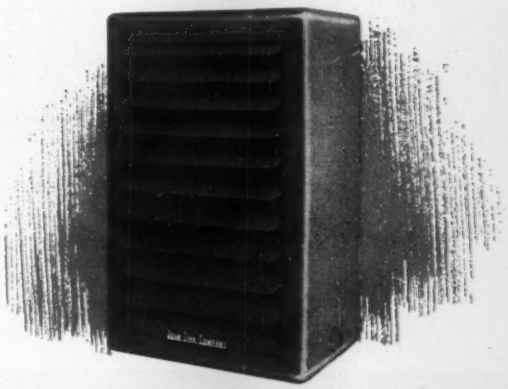


SERIES "R" BI-AIR BURNER

4" to 1#

For all types and sizes HEATING BOILERS and small Power Boilers — JOHN ZINK offers the Series "R" Bi-Air short flame, Gas Burner with Multi-Jet burners, having refractory semi-venturi mixing throats, with a separate gas orifice to each throat. Capacities to meet your requirements.

Especially adapted for installing in boilers having very low draft and small combustion space.



SUSPENDED UNIT HEATER

The John Zink UHS Gas-fired fan type suspended heater is a complete, packaged unit and fully automatic. A. G. A. approved for natural, mixed, manufactured or LP Gas.

For industrial applications, J.Z. Central Heating Units can be installed on a shelf or balcony, as a suspended heater or as a duct heater. Ratings from 65,000 Btu/hr.

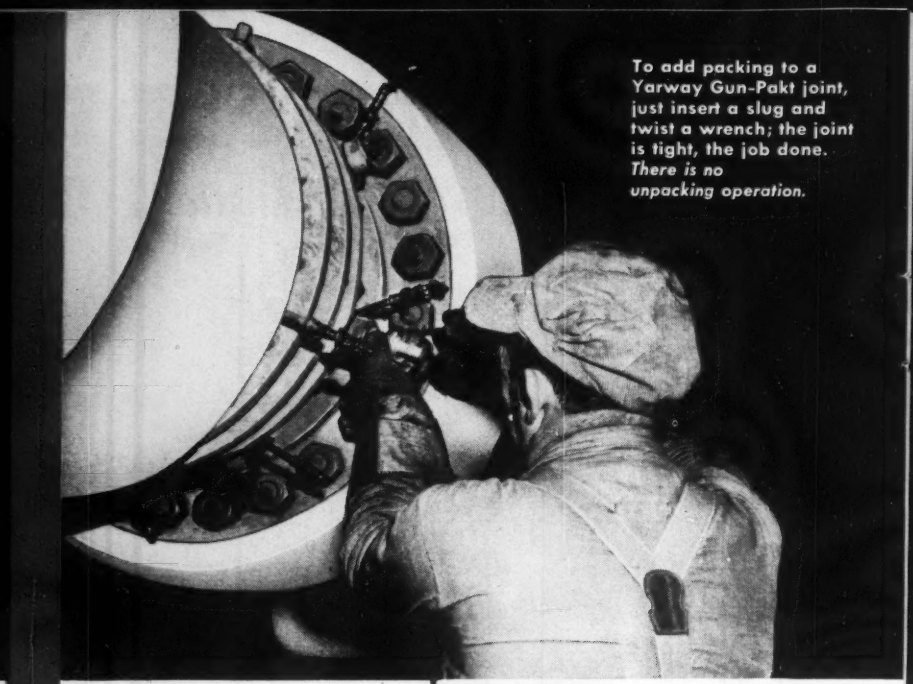
WRITE FOR LITERATURE

JOHN ZINK COMPANY

4401 South Peoria Tulsa 5, Oklahoma

STARTLING NEW FACTS ON EXPANSION JOINT MAINTENANCE

It may cost less than you think to service expansion joints. Look at these records from three typical users of Yarway Gun-Pakt Expansion Joints:



To add packing to a Yarway Gun-Pakt joint, just insert a slug and twist a wrench; the joint is tight, the job done. *There is no unpacking operation.*

	YARWAY GUN-PAKT JOINTS	CONVENTIONAL GLAND-PACKED JOINTS
STATE UNIVERSITY*	Required addition of only 3 slugs (45 cents) of packing in 5 years. Lubrication only once every 6 months. Total labor time of only 2 manhours in 5 years.	Same lubrication as Gun-Pakt, *plus* gland tightening, *plus* complete overhaul with shutdown for unpacking and repacking every 3 to 4 years. Time for overhaul—25 manhours per joint!
MID-WEST AIRFIELD*	Only maintenance was lubrication and addition of 2 slugs (30 cents) of packing per year. Total labor ¼ manhour per joint per year.	Lubrication and gland tightening required 8 manhours per joint per year—plus complete unpacking and overhaul every 2 to 3 years. Time required for overhaul—20 manhours per joint.
"BIG TEN" UNIVERSITY*	Lubrication only once every 2 months, with packing added as needed. Total labor time charged, 1 manhour per joint per year.	General maintenance requires 6 manhours per joint per year. Complete overhaul required every 2 to 3 years with unpacking and repacking—24 manhours per joint.

*Names on request.

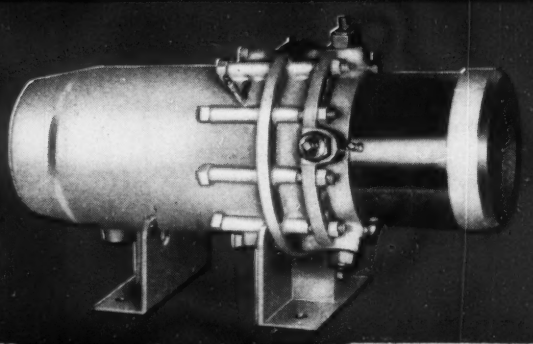
To get the full facts on Yarway Gun-Pakt Expansion Joints, and how they can save you maintenance money, write for Yarway Bulletin EJ-1913.

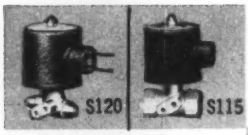
YARNALL-WARING COMPANY
107 Mermaid Ave., Philadelphia 18, Pa.

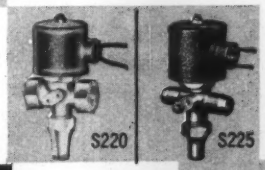
YARWAY

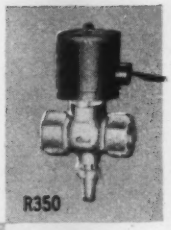
gun-pakt expansion joints

Yarway single-end, welding type Gun-Pakt joint for pressures to 300 psi, heavier design for higher pressures. Single-end traverses up to 12 inches; double-end up to 24 inches.

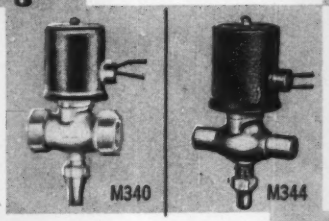




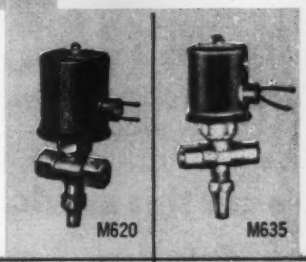




ALCO SOLENOID VALVES

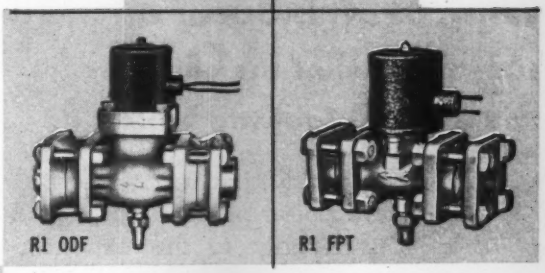


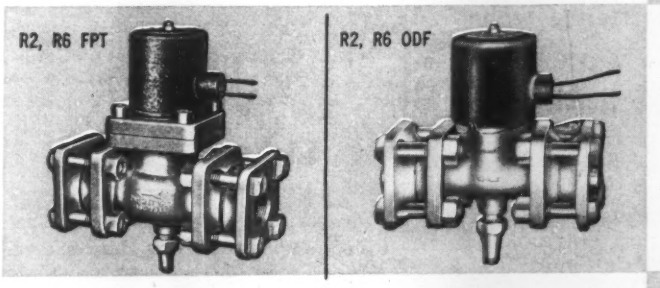
the complete line



- for Freon-12, Freon-22, Methyl Chloride and Ammonia
- for liquid line, suction line or hot gas discharge service
- for brine, water, steam, air, oil
- for all types of electric current
- for wide range of connections: ½" to 2⅝" solder, ⅜" to 2" pipe thread
- for use with thermostats, float switches, timers, and many other control devices

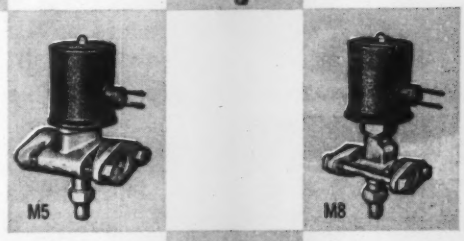
Special valves for special applications are available.





Our Bulletins 173 and 182 give complete technical information. Send for your free copies today.

SEE YOUR ALCO WHOLESALER



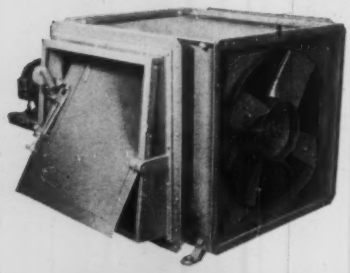
ALCO VALVE CO.

861 KINGSLAND AVE. • ST. LOUIS 5, MO.

5686

"...Let's cut this stack off here and put a Wing Draft Inducer on the boiler...We'll save the cost of the chimney, have better draft and a better looking building."

If you are building or rebuilding or increasing the size of your boiler plant, a costly, tall chimney can add considerably to the expense. And a well planned architectural design can be ruined with an unsightly, towering stack.

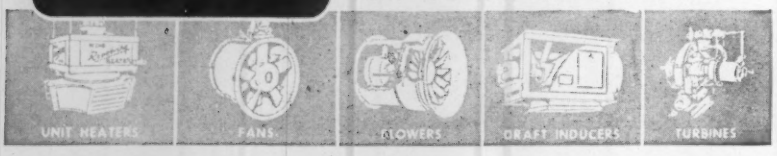


WING DRAFT INDUCERS eliminate this problem, providing positive, adequate, uniform draft regardless of surrounding conditions, or variable weather. They cut operating costs too, by giving higher CO_2's. Smoking is reduced or eliminated. Higher boiler capacity is possible.

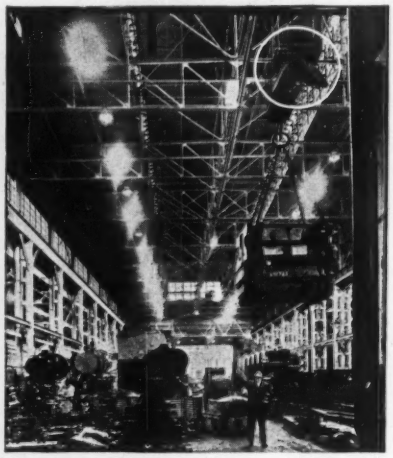
Write for Bulletin I-52

Wing

L. J. Wing Mfg. Co.
140 Vreeland Mills Road
Linden, New Jersey
Factories: Linden, N.J. and Montreal, Can.



HEAT THAT MOVES AROUND



with the WING REVOLVING HEATER

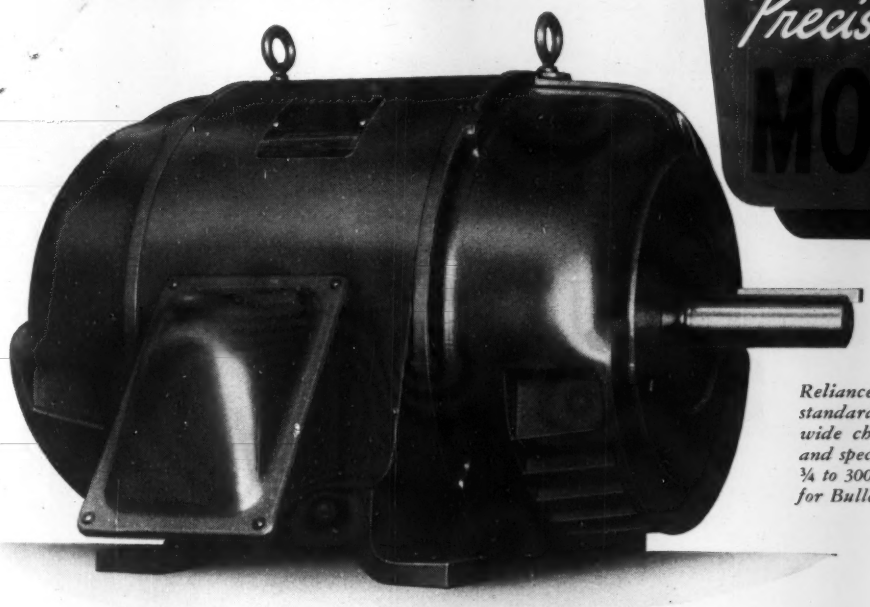
The fact that the discharge outlets of Wing Revolving Heaters keep the heated air in gentle, constant motion is the reason firms like the Budd Company have installed Wing Revolving Heaters in their plants, both at Philadelphia, and at the plant shown in the photograph above at Gary, Indiana. Big blanking and forming presses make a natural barrier to ordinary heating systems, but

not to the moving streams of heated air from the Wing Revolving Heaters, even suspended, as they must be, far above the floor to clear the cranes. Uniform distribution is accomplished because the moving streams of heated air sweep slowly around through 360 degrees, covering successively every direction; thus every part of the plant is kept at a comfortable temperature. And in Summer, with the steam turned off and fans on, the revolving discharge outlets create a sensation of pleasing coolness that is very refreshing even on the hottest days. Write for a copy of Bulletin HR-6 to L. J. Wing Mfg. Co., 140 Vreeland Mills Road, Linden, New Jersey.

FOR COMPRESSOR SERVICE...

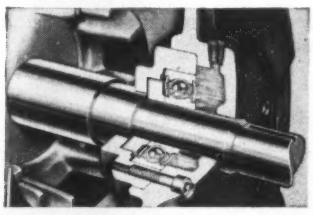
"All motors are NOT alike!"

RELIANCE *Precision-Built* **MOTORS**



Reliance Splashproof Motor. All other standard enclosures available, with wide choice of mechanical designs and special mountings. Ratings from ¾ to 300 hp. Get the full story—ask for Bulletin B-2101.

- ☆ Low starting currents... high starting torque ...liberal ratings
- ☆ Smooth acceleration... quiet operation
- ☆ Tough, vibration-proof Reli-X insulation



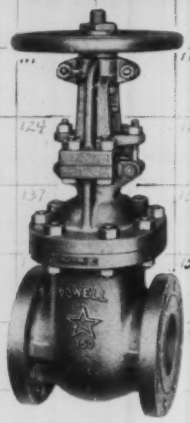
...AND THE BEST PRE-LUBRICATED BEARING DESIGN

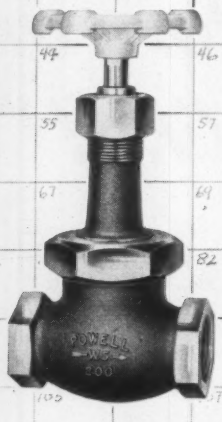
The Reliance pre-lubricated bearing provides *four times more operating hours without re-lubrication* than any other bearing used in motors today. And—whatever your lubrication schedule—*you just can't grease 'em wrong!* To get the complete "inside story" on motor bearings, write today for Bulletin B-2201. It contains hard facts on the advantages of the Reliance pre-lubricated bearing design, with cutaway view, cross-section diagram, comparison chart, and statements by bearing manufacturers. B-1458C

RELIANCE ELECTRIC AND ENGINEERING CO.

1052 Ivanhoe Road, Cleveland 10, Ohio • *Sales Representatives in Principal Cities*

DEPENDABILITY IN 2 LETTERS





TOP

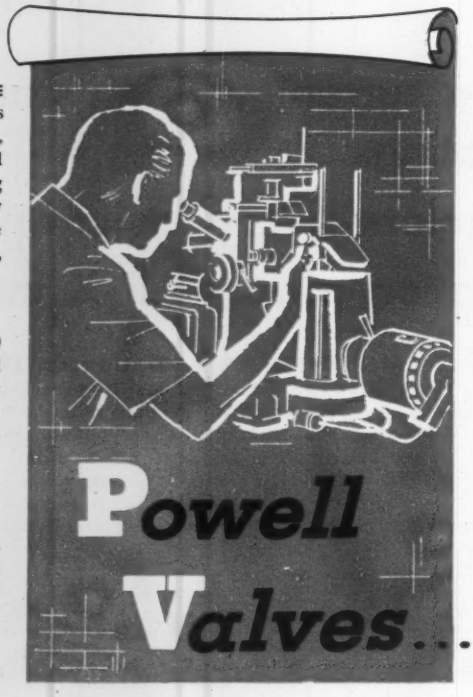
BRONZE "W.S." FULL FLOW GLOBE VALVE *(Fig. 2608)* For 200 pounds W.P. Regrindable, renewable, hardened stainless steel seat and disc. Nominal pipe size opening through seat permits fuller flow with pressure drop and turbulence cut to minimum. Sizes, ⅛" to 3", inclusive.

LEFT

CAST STEEL GATE VALVE *(Fig. 1503)* 150 pounds. Flanged ends, bolted flanged bonnet with outside screw rising stem and yoke. Solid wedge. Available in sizes 1" to 24", inclusive.

RIGHT

"MODEL STAR" GATE VALVE *(Fig. 1793)* For 125 pounds W.P. Iron body, bronze mounted. Supplied with taper solid wedge. Sizes 2" to 30", inclusive.



The life of a valve bears a certain relation to the life of the company that produces it. Powell has had a solid, oak-like growth for over a hundred years. That's only possible because The William Powell Company makes dependable valves.

Today, Powell Valves are proving their dependability in a greater variety of installations than any other valves in the world. And Powell is very likely the leader in research as well as development of special valves to overcome flow control problem situations.

All good reasons why PV, for Powell Valves, appears on more specifications year after year.

THE WILLIAM POWELL COMPANY
CINCINNATI 22, OHIO

CONTROLS FOR THE LIFE LINES OF INDUSTRY

LOOK FOR these important differences in Unit Heaters

Compare these two great Modine models with all other makes

Horizontal Delivery Unit (left) is built in 19 standard and low-outlet temperature steam models; 5 hot water models. Verticals offered in 26 models, 13 sizes for steam and hot water.

YOU get a *big plus* in unit heating when you specify Modine. Advanced engineering balances all performance factors...assures perfect heating comfort at low overall cost.

Take the new Modine Vertical, for example. Rugged, durable construction assures long life. Yet a major reduction in weight and bulk means important savings in installed cost. The largest model (2540 Edr) weighs only 284 pounds.

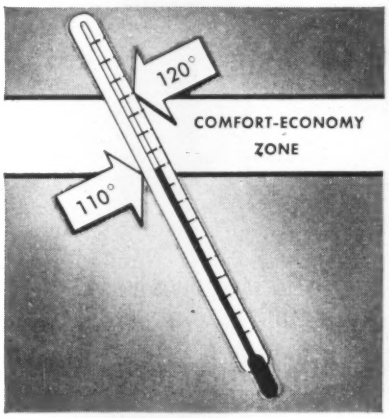
Or, if a horizontal delivery unit meets your needs — Modines can be suspended directly from overhead piping without other supports. Simple, attractive styling fits any commercial or industrial application.

Yes, whatever your heating requirements — *compare first!* You'll choose Modine . . . *every time!*

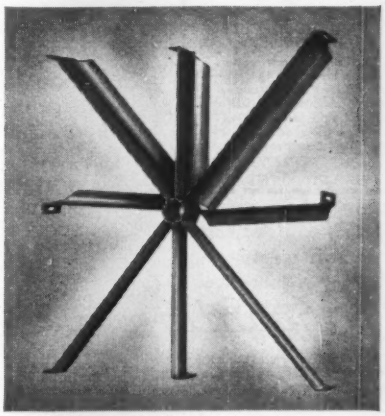
Get Bulletin 153 from the Modine representative listed in your classified phone book, or write Modine Mfg. Co., 1509 DeKoven Ave., Racine, Wisconsin.

Modine
UNIT HEATERS

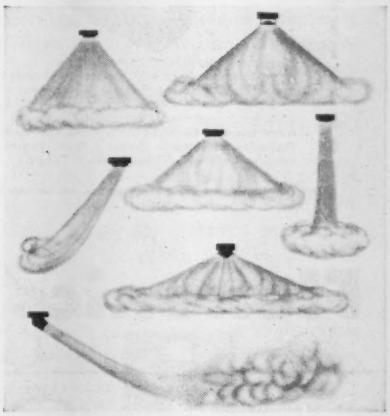
Three of many outstanding features that account for Modine's quality reputation



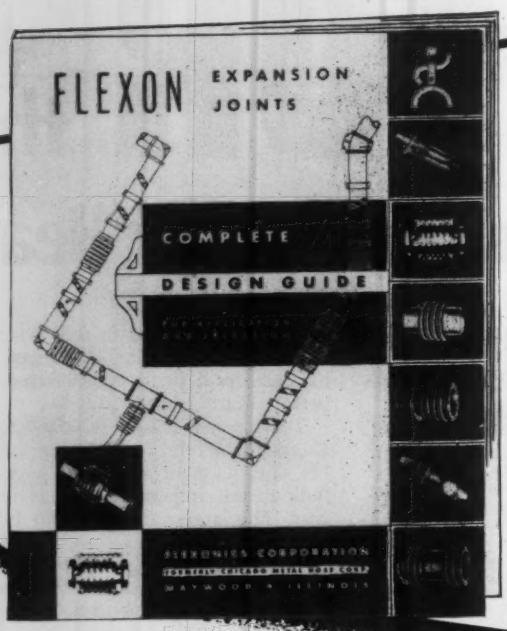
All models have discharge air temperatures in the 110° to 120° F. range correctly related to air velocities for adequate heat throw, perfect comfort, lower fuel costs.



Built-in velocity generator of horizontal units effectively steps up heat throw. This assures positive heat penetration of cold air strata near the floor.



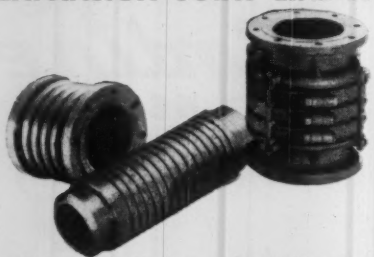
Vertical units offer unmatched versatility in heat and air distribution. Choice of 5 easily attached, optional deflectors to meet practically any heating need.



THIS NEW AUTHORITATIVE GUIDE TO PIPING MOTION CONTROL SHOULD BE AN IMPORTANT PART OF YOUR BASIC ENGINEERING FILE

The New FLEXON Expansion Joint Design Guide

THE FLEXON EXPANSION JOINT LINE-UP



Flexonics Corporation manufactures a complete line of corrugated type stainless steel and copper expansion joints in Free-Flexing (low pressure), Controlled-Flexing (high pressure) and Flexoniflex (extremely high pressure) units. Sizes range from ½" to 48". Units are available for temperatures from —400° F., to 1600° F., and for pressures from vacuum to 5500 psi. Write for further information or see the Flexonics catalogs in Sweet's Plant Engineering File, Chemical Engineering Catalog or The Refinery Catalog.

Now at last, comprehensive, up-to-date information on the absorption of motion in piping has been gathered together in one easy-to-use booklet. In its new Expansion Joint Design Guide, Flexonics Corporation offers an authoritative handbook of piping design and layout! Included in the booklet are thorough discussions of types of motion, design considerations pertaining to the physical characteristics of expansion joints and anchoring and guiding, typical piping layouts, computation of thermal expansion, safety factors and many other vitally important factors in piping design.

Much of the information presented is available nowhere else; all of it helpful to anyone responsible for the design, installation or maintenance of piping. Copies of the Flexon Expansion Joint Design Guide are available without charge. Write for your copy, today.

Flexonics *Corporation*

EXPANSION JOINT DIVISION
1391 S. THIRD AVENUE • MAYWOOD, ILLINOIS

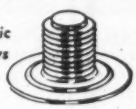
FORMERLY CHICAGO METAL HOSE CORPORATION
In Canada: Flexonics Corporation of Canada, Ltd., Brampton, Ontario

Flexon identifies products of Flexonics Corporation that have served industry for over 50 years.

Flexible metal hose

Expansion joints

Aircraft components


Metallic bellows

a **quick**
source of
exceptionally

*dependable

air conditioning and refrigeration pumps

Marlow offers a wide range of pumps designed expressly for *circulating water through cooling towers* and *evaporative coolers*. These quiet and compact pumps are immediately available from 3 convenient factory stocks at De Queen, Arkansas (near Texarkana), Ridgewood, New Jersey, and Chicago, Illinois.

Many *Unusual Construction Features are built into these pumps. They are *non-overloading*. *Impellers* are *LOCKED ON* and will not loosen even if accidentally started in reverse. A *stainless steel shaft* prevents corrosion, base is made of *unbreakable* wrought steel and operation is exceptionally *quiet*. Over a quarter of a century of specialized pump experience insures peak performance and completely dependable operation. Write for full details.

WORLD'S LARGEST MANUFACTURER OF SELF-PRIMING CENTRIFUGAL PUMPS

MARLOW PUMPS • RIDGEWOOD, N.J.

Branch Plant • De Queen, Arkansas

for lower cost control of moderately **Corrosive** fluids

Fig. 2651-A Gate

JENKINS

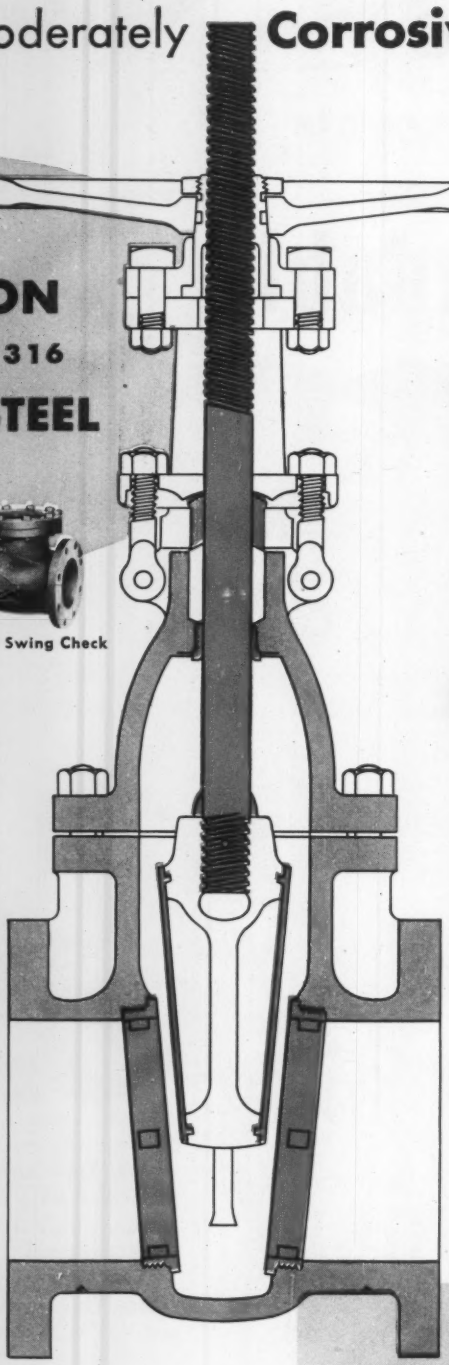
NICKEL IRON

Valves with Type 316

STAINLESS STEEL

Trim

Fig. 2624 Swing Check



This combination provides corrosion resistance well above the moderate need in many processing services with an investment well below that for all-stainless steel valves.

Designed primarily for the chemical process industries, they are recommended for control of mildly corrosive liquids with minimum quantities of mineral acids, such as creosote in wood treatment, and many liquids carried in petroleum processing.

A major use is in pulp and paper processing, particularly in lines serving the digester, and in the chemical recovery cycle. Service records in lines carrying the valve-punishing "black liquor" give Jenkins Nickel Iron Valves top performance rating.

Jenkins *extra value* construction throughout. Get details — compare. See why they stretch your valve investment dollar — with longer service life, lower maintenance cost.

Every part in contact with fluid is the right metal to block corrosion and beat wear.

Cast NICKEL IRON

- **BODIES** Heavy duty, dimensioned for greater resistance to wear and abuse. Through port design in Gate Valves.
- **BONNET** Rugged construction, like body. Swing-type gland bolts. Screwed-in back-seating bushing. Deep stuffing box.
- **YOKE** Integral with bonnet in 2″ to 4″ sizes.
- **WEDGE** In 10″ to 24″ sizes, with Stainless Steel Wedge Rings.
- **COVER** In Check Valve.

Type 316 STAINLESS STEEL

- SPINDLE
- GLAND
- BONNET BUSHING
- SPINDLE RING
- WEDGE PIN
- WEDGE RINGS Rolled into Nickel Iron Wedge in 10″ to 24″ sizes.
- SEAT RINGS
- DISC and HANGER in Gate Valve

NI-RESIST Type No. 2

- WEDGE of I-beam structure is solid NI-RESIST in 2″ to 8″ sizes.

PRESSURE RATINGS

2″ to 12″—200 lbs. O.W.G.
14″ to 24″—150 lbs. O.W.G.

GET COMPLETE SPECIFICATIONS from your Jenkins Valve Distributor, or write: Jenkins Bros., 100 Park Ave., New York 17. Ask for Bulletin 118.

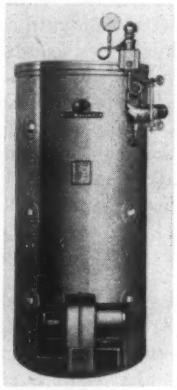
JENKINS
LOOK FOR THE DIAMOND MARK
VALVES
SINCE 1864 TRADE JENKINS MARK
Jenkins Bros

EQUIPMENT DEVELOPMENTS...

Add the new products and companies listed here to your Directory Section which you received in your January 1954 Heating, Piping & Air Conditioning, and thus keep your records of sources of supply up to date throughout the year. Single asterisk indicates equipment not listed in Directory Section; double asterisk, equipment and manufacturer not listed.

Steam Heaters with Turbine Driven Fans

Heater driven by steam to provide modulated, zone controlled, filtered warm air heating. . . Known as "SelecTemp," it is said to be useful for all space heating applications. Each heater is an automatic unit consisting of a heat exchanger, forced air blower, turbine drive for blower, air filter, thermostat and return trap, packaged into a steel housing with a grille face. The unit may be fitted into the wall stud space with the outer grille extending beyond the surface of the wall. Three sizes are available with output capacities of 6000, 12,000 and 18,000 Btu per hr.



Above: Heater
Left: Generator

Low pressure steam enters the unit through a ¼ in. nominal ID copper tube supply line. After passing through the small turbine, which drives the air circulating fan, the steam enters the heat transfer core where it is condensed. The condensate then leaves the unit through a ⅛ in. nominal ID copper tube return line.

Room air enters the unit through the lower grille opening, passes through an air filter, the heat transfer core and the circulating fan. The warm air is then discharged through adjustable vaned openings which control the vertical and horizontal distribution of the heated air. Under normal operation, the thermostat modulates the flow of heat from 1/20 of capacity to full capacity.

The company's "MS Series" steam generators provide a source of low pressure steam supply for use with the heating system. The generators are available in gas fired and oil fired models and are constructed to meet the requirements of the ASME Code.

Manufacturer—Iron Fireman Mfg. Co., SelecTemp Div., 3170 W. 106th St., Cleveland 11, Ohio.

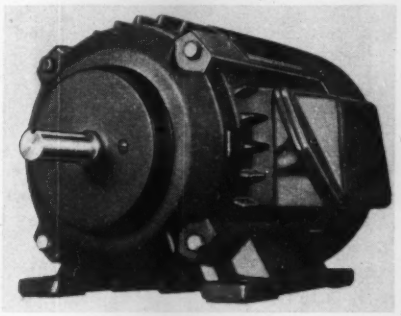
Commercial Air Conditioners

**Line of nine air conditioning systems for 1954 includes, for the first time, three models for commercial applications in addition to six new models for home use. . . . Included in the new line are a packaged evaporative condenser and compressor in 2, 3 and 5-ton sizes; water-cooled condensers of 2 and 3-ton capacities, and an evaporative condenser in 2, 3 and 5-ton sizes for commercial installations. Models for commercial use have a special plenum section which has been acoustically treated. The manufacturer claims that the evaporative condenser permits a 97 percent saving in water and reduces electric power requirements 25 percent.

Manufacturer—The Coleman Co., Wichita, Kan.

Protected Induction Motors

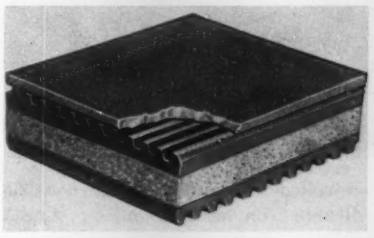
New line of protected and enclosed squirrel-cage induction motors built to NEMA standards. . . . The first of the new motors to appear will be built for 1, 1-½ and 2 hp applications, in frame sizes 182 and 184. The balance of the line, up to and including 30 hp, will be introduced at regular intervals during 1954 and the early part of 1955. The present a-c line will continue to be available during the change-over period. According to the manufacturer, open motors will be replaced by protected machines. The company also states that the new totally-enclosed fan-cooled motors are built to operate under a wider variety of adverse atmospheric conditions and in any mounting position.



Manufacturer—Reliance Electric & Engineering Co., 1088 Ivanhoe Rd., Cleveland 10.

Vibration Damper

"VPS Elasto-Rib Damper," a vibration isolating material designed to eliminate bolting of machinery and to facilitate rearrangement of production lines. . . . According to the manufacturer, this pad-type damper adds mobility to heavy equipment by giving a non-skid surface which resists shifting or creeping of the machine. The damper utilizes the elastic and damping



EQUIPMENT DEVELOPMENTS . . .

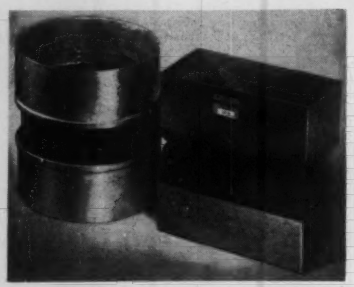
[*Continued*]

properties of both cork and rubber. It has a core of cork plate bonded between two layers of oil resistant neoprene rubber deeply grooved. It is furnished with a load distributing top plate designed for use where the machine leg is smaller than the area of the pad required. It may be bolted or cemented when required by special conditions.

Manufacturer—The Korfund Co., Inc., 48-01F 32nd Place, Long Island City 1, N. Y.

Flexible Duct Connection

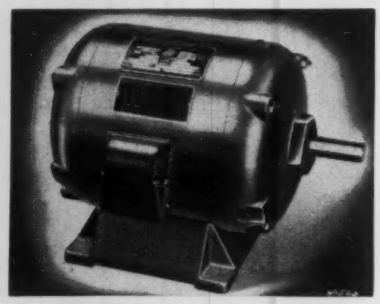
Flexible duct connection designed to abolish vibration noise. . . . One feature of the "Silent Duct" is that the metal and material are factory-assembled into a single unit. The duct is made of 24-gage galvanized steel fastened to canvas that is fire, water and mildew resistant. It is also available in non-porous asbestos. It is delivered in 100-ft coils in a carton which serves as a dispenser. The needed amount of material may be pulled out ready to cut, bend and seam.



Manufacturer—Elgen Mfg. Co., 41-34 39th St., Long Island City 4, N. Y.

Integral Horsepower Motors

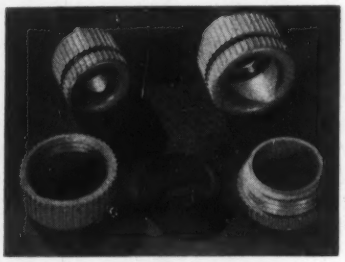
New line of integral horsepower motors designed to facilitate the changeover to the new NEMA standards. . . . The firm is offering the new motors in either the present or in new mountings. Initial production will be in the 1, 1-½ and 2 hp ratings. All performance characteristics of the old and new motor lines will be equal. Contour lines and styling are the same. The new design consists of a rolled steel main frame construction with attached malleable iron base mounting. End frames are of cast iron. Rotor diameter fans are employed, the blades being cast integral with pressure cast end rings and rotor bars. This assembly rides on ball bearings.



Manufacturer—A. O. Smith Corp., 3533 N. 27th St., Milwaukee 1, Wis.

Plastic Clamp for Pipe Fittings

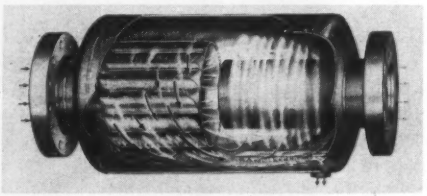
*Molded plastic clamp used to effect a tight seal when sections of flexible plastic pipe are connected by means of insert couplings, tees, ells and adapters. . . . It is slipped over the pipe ends and tightened to force them down onto the serrations incorporated in insert fittings. The clamp is molded in two separate threaded sections. Butted against a shoulder at the base of the female threads in one half is a synthetic gasket with a V-shaped groove. When the other half of the clamp is screwed down onto this gasket, it is forced against the pipe. The 360 deg pressure exerted on the pipe makes it grip the insert fittings tightly. The clamp is produced in sizes for ½, 1, 1-1½, 2, 3, 4 and 6-in. plastic pipe. It is tightened by a strap wrench and can be removed and reused when pipe installations are changed.



Manufacturer—Carlon Products Corp., 10225 Meech Ave., Cleveland 5.

Moisture Separator

Moisture separator for use in horizontal steam, air and gas lines. . . . The "31-N" installs in a minimum of space, the manufacturer states. It is said to be self-cleaning and may be used with a wide range of pressures. Construction is fabricated steel. The principle of centrifugal force is applied for removing entrainment, including water, oil and solids from the pressure line.



Manufacturer—Wright-Austin Co., 3245 Wight St., Detroit 7.

Drawer-Type Conditioner for Casement Windows

New conditioner small enough to fit casement windows, controlled by pulling out the front panel. . . . It is 14½ in. wide and may also be used with standard windows. The conditioner has no visible controls. It is operated by grasping the handle on the front and pulling the drawer out to one of three different positions. The first position provides ventilation alone, the second provides both cooling and ventilation, and the third provides maximum cooling. Air is circulated by aluminum propeller-type fans through grilles set at 45-deg angles. The cooler is powered by a hermetically sealed electric refrigerating unit housed outside the window. According to the manufacturer, the unit will remove nearly

Unique heat exhaust problem solved

POWER-FLOW ROOF VENTILATOR

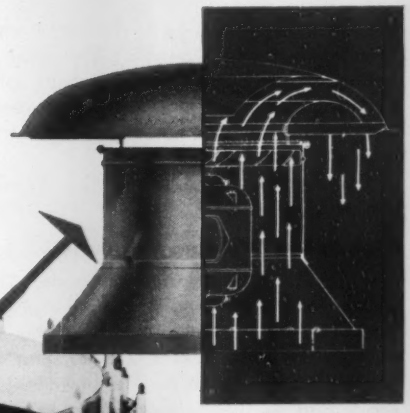
exhausts hot air from plastic dome of new Ford Rotunda

The new Ford Rotunda, built to mark Ford Motor Company's 50th Anniversary, presented a unique ventilation problem. The dome is constructed of plastic which allows heat from the sun to pass through, forming a pocket of hot air below. This hot air had to be removed. A DeBothezat Power-Flow Roof Ventilator, installed in the dome top, proved to be the solution. With its 36" fan wheel operating at top speed, the Power-Flow Ventilator exhausts hot air from the dome at the rate of 8,000 CFM.

A motor-driven fan in a weatherproof housing, the DeBothezat Power-Flow Roof Ventilator solves both unique and common ventilating problems in industry. Power-Flow Ventilators are installed with or without duct systems, for either air exhaust or intake. They are available with fan wheels 12" through 48" in diameter, delivering up to 40,900 CFM. Whether your operation requires a single ventilator or a multiple unit system, Power-Flow will meet your requirements.

With a DeBothezat, you get all the air you pay for. DeBothezat capacity ratings are the output of completely assembled units, including the head, obtained from wind tunnel tests prescribed by the Power Fan Manufacturers Association. In selecting fan equipment, always be sure the ratings given are not based on the capacity of the fan alone.

Certified Ratings — AMA



Low, streamlined silhouette of Power-Flow Roof Ventilator harmonizes with Ford Rotunda's geodesic dome (Architect, R. Buckminster Fuller). DeBothezat manufactured this unit specially in aluminum to match the framework of the geodesic dome and to save weight.

Send for DeBothezat Bulletin DR-3-52.

FREE!

DeBothezat Fans

DIVISION OF AMERICAN MACHINE AND METALS, INC.
EAST MOLINE, ILLINOIS

DeBOTHEZAT FANS
Division of American Machine and Metals, Inc.
Dept. HPAC-254, East Moline, Illinois

Please send Power-Flow Bulletin DR-3-52.

COMPANY

ADDRESS

CITY ZONE STATE

NAME AND TITLE

EQUIPMENT DEVELOPMENTS . . .

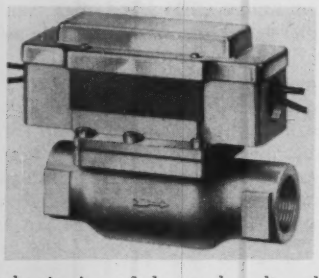
[*Continued*]

two pints of moisture per hr but does not require a drain or plumbing connection.

Manufacturer—Servel, Inc., Evansville, Ind.

Gas Control Valve

Main control valve designed to eliminate a great deal of noise through the use of a rotor operating in a magnetic field instead of a solenoid. . . . The "Actrol" valve comes in the 3/4 in. size and is said to have a capacity of 170,000 Btu per hr with manufactured gas and 252,000 with natural gas. According to the manufacturer, characteristics of this valve are such that greatest force is



exerted at the beginning of the stroke when the valve must open against gas pressure. The valve closes against a synthetic rubber seat. The company also states that installation is simplified since the transformer is built into the control and can be turned end for end to facilitate wiring.

Manufacturer—Milwaukee Gas Specialty Co., P. O. Box 461, Milwaukee, Wis.

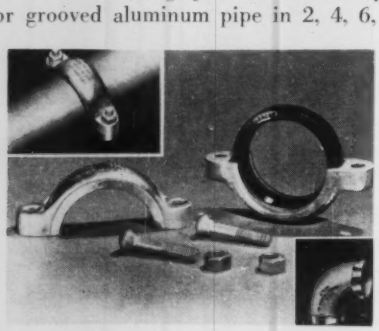
High Speed Welding Electrode

Welding electrode, "Easyarc 12," for welding mild steel involving plate and rolled sections. . . . According to the manufacturer, the speed is doubled through the addition of a large amount of powdered metal to the electrode coating. The powdered metal changes the arc action so that welds can be made by dragging the electrode in contact with the plate. The metal powder becomes part of the weld bead.

Manufacturer—Air Reduction Sales Co., 60 E. 42nd St., New York 17.

Aluminum Couplings and Fittings

*"Gruvagrip" aluminum couplings and fittings for grooved aluminum pipe in 2, 4, 6, and 8 in.

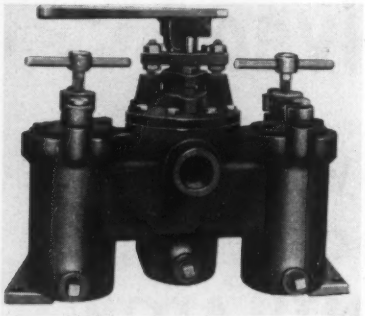


sizes. . . . According to the manufacturer, the couplings automatically absorb expansion and contraction, shock, ground motion and vibration. They reportedly remain leakproof under end pulls up to 46,000 lb, permit layout misalignment up to 3 deg, and withstand temperatures between 200 F and −65 F. They are designed to be removed and reused. The company states that they are suitable for permanent or temporary lines carrying air, vacuum, gases, water, oil and chemicals. The sealing gasket is of resilient synthetic rubber.

Manufacturer—Gustin-Bacon Mfg. Co., 210 W. Tenth St., Kansas City 6, Mo.

Oil Separators for 250 Lb Pressures

*New simplex and duplex type oil separators for pressures up to 250 lb per sq in. . . . The filters can be used for coarse straining or fine filtration. Perforated metal strainers are used for separating particles down to 1/64 in. For finer separation, either metal or fabric cloth filters are used. A yoke-type holder at the top of the filter housing is designed to simplify removal of the various elements. Both types of separators have special

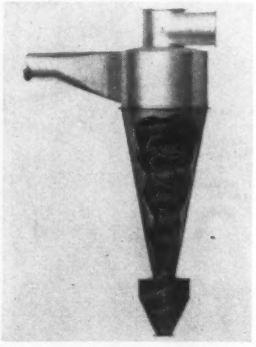


adjustable positioning collars for accurate location and seating of a hand lapped rotor. An adjustable stuffing box is completely independent so gland adjustments are made without disturbing rotor clearance settings.

Manufacturer—Eclipse Fuel Engineering Co., 1139 Buchanan St., Rockford, Ill.

Mechanical Dust Collector

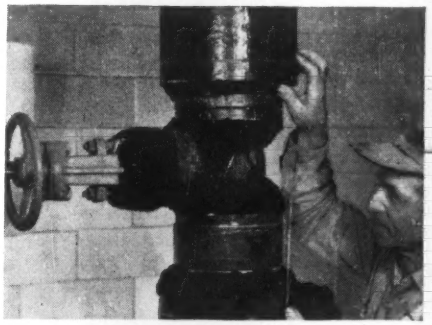
Mechanical dust collector which separates dust from air by means of centrifugal force. . . . The



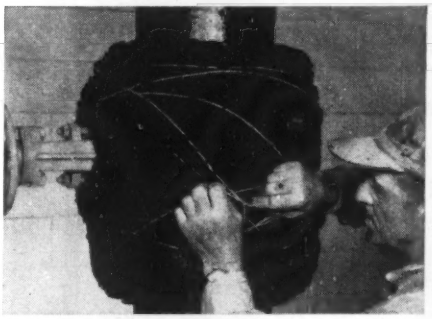
"Dustmaster" is of cylcone design and is designed to be operated either under suction or pressure. Body diameters range from 18 in. to 84 in. It is available in single, duplex, quadruplicate and two-stage arrangements. According to the company, the collector is recommended for collecting and separating dry industrial dusts when the gas

[*Continued on page 198*]

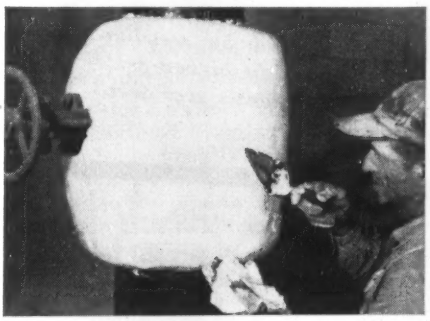
New material simplifies insulation of cold lines



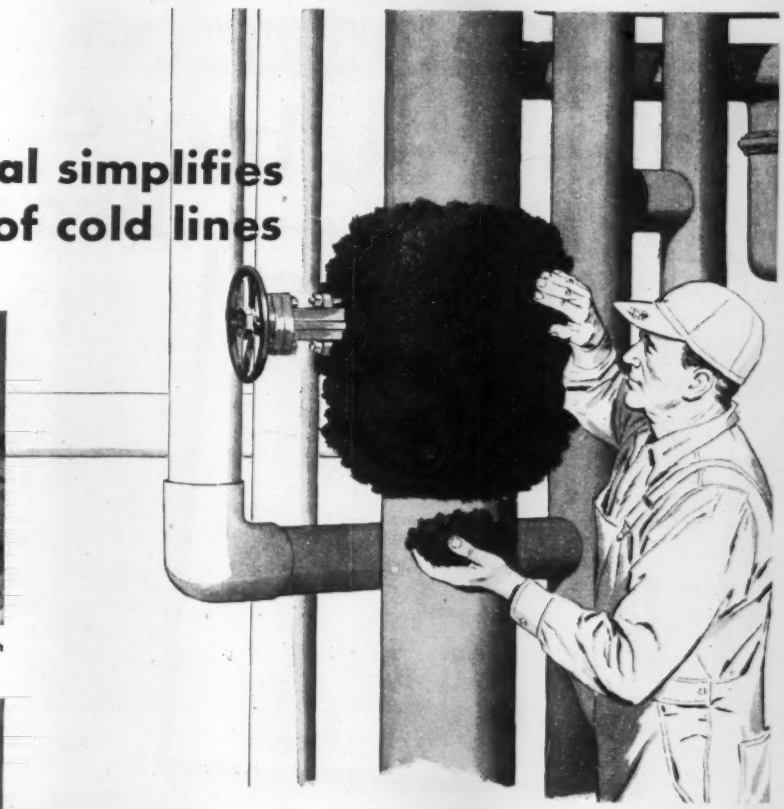
1. Prime fitting with Plasticork Primer . . . when dry, pack Plasticork firmly into voids.



2. Build Armstrong's Plasticork to required thickness and hold in place with twine.



3. Apply Keene's Cement, Weatherproof Plastic, and No. 1 Cork Covering Paint.



Armstrong's Plasticork can be used on any cold line fitting

Cutting standard molded covers to fit in close quarters or over nested fittings is a time-consuming task. Building covers on the job for these hard-to-insulate places is slow and expensive. Waiting for molded covers for special fittings to be made up and shipped to the job site can also delay the work. Plasticork* eliminates all these problems. With Plasticork on hand, the workman builds the fitting cover as he goes, does a speedy and efficient job.

Plasticork is a new, moldable granulated cork-and-rubber cold line insulation. The workman actually molds it to the proper size and thickness, shaping it by hand to the fitting he is insulating. In some applications, Plasticork may entirely eliminate the use of regular molded fitting covers. In others, it will supplement them.

Plasticork can be held in stock for years without losing its moldable characteristics. This means it can also be removed from a fitting and used over again without loss of insulating efficiency or workability.

A stock of Armstrong's Plasticork in your warehouse or storage room will allow you to have on hand at all times the material necessary to insulate any fitting. For a free booklet fully describing Armstrong's Plasticork and its use, call your nearest Armstrong office or write Armstrong Cork Company, 2102 Sherman Street, Lancaster, Pennsylvania.

* T.M. Reg. applied for

ARMSTRONG'S INDUSTRIAL INSULATIONS

For temperatures from 300° below zero to 2800° F.

WHAT TO LOOK FOR

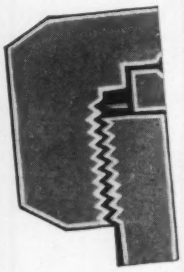
when you buy a Bronze Valve

1 LOOK FOR DESIGN. Use the right valve for the right type of service at the right pressure. There is no such thing as an "all-purpose valve" . . . so don't try to make *one* valve do. *In the complete Lunkenheimer line, there are 125 basic bronze valves — each ideal for a certain type of service. Get your Lunkenheimer Distributor's recommendations.*

2 LOOK FOR OPERATING FEATURES, particularly those that make the valve longer-lasting and easier to use, such as the handwheel. *Lunkenheimer patented Non-Slip® Handwheel assures a firm, cool grip—makes it easy to close the valve tight, reducing wear and eliminating leakage. All Lunkenheimer Bronze Valves have the new Non-Slip Handwheel, along with many other exclusive operating features.*

3 LOOK FOR A LONG-WEARING STEM, since stem-thread wear is one of the most common causes of valve failure. *Lunkenheimer Bronze Valves have Stemalloy® Stems — an exclusive silicon-bronze alloy which completely eliminates stem-thread failure. Not one of the millions of Stemalloy Stems now in service has ever been returned because of thread wear.*

4 LOOK FOR CLOSE-GRAINED BRONZE, the mark of valve quality. Dense bronze not only increases the valve's strength, but makes it much more resistant to corrosion. *Lunkenheimer Bronze Valves are made of original Lunkenheimer alloys recognized by metallurgists as the highest-grade valve bronzes ever developed.*



Remember—The Price Of A Lunkenheimer Valve Gets Smaller And Smaller And Smaller With Each Passing Year Of Dependable Service

ALL POPULAR SIZES of Lunkenheimer Bronze Valves are maintained in stock for prompt delivery. Write for new Circulars 534, 582, and 574 describing typical designs. The Lunkenheimer Co., Box 360N, Cincinnati 14, Ohio.

LUNKENHEIMER ® QUALITY

BRONZE • IRON • STEEL

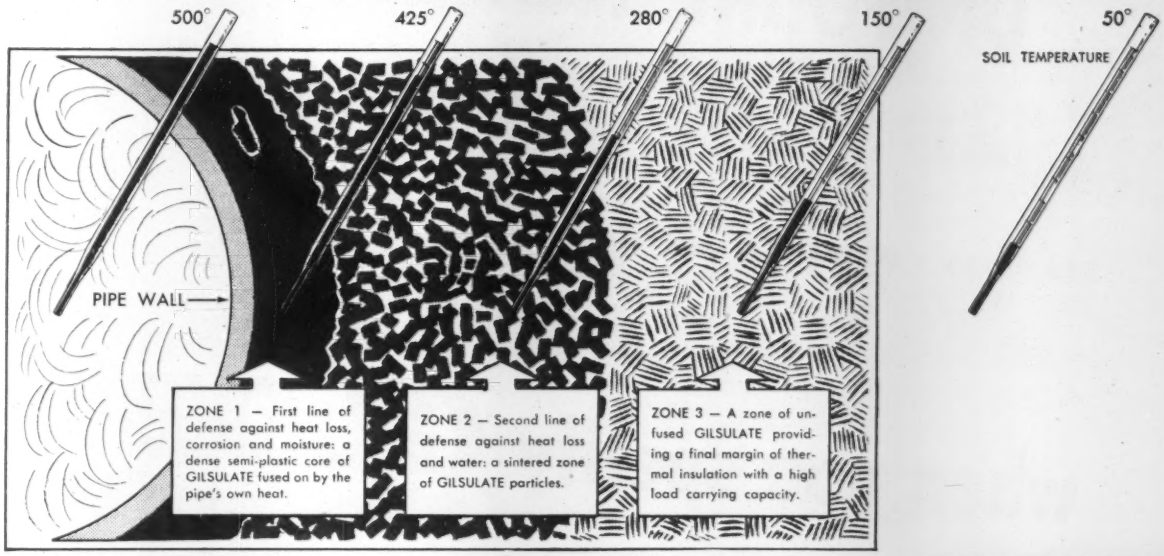
LUNKENHEIMER®

THE ONE *Great* NAME IN VALVES

L-154-15

Lowest Cost

PER INSTALLED LINEAR FOOT OF ANY HOT UNDERGROUND PIPE INSULATION


500°
425°
280°
150°
50°
SOIL TEMPERATURE
PIPE WALL
ZONE 1 — First line of defense against heat loss, corrosion and moisture: a dense semi-plastic core of GILSULATE fused on by the pipe's own heat.
ZONE 2 — Second line of defense against heat loss and water: a sintered zone of GILSULATE particles.
ZONE 3 — A zone of unfused GILSULATE providing a final margin of thermal insulation with a high load carrying capacity.

GILSULATE®... the triple-zone insulation that fuses itself into lifetime protection for hot underground pipes. Water-proof, corrosion-proof, root-proof, acid/alkali-proof.

Compare your present insulation methods with Gilsulation:

1. Pour Gilsulate granules out of the bag onto the pipe; tamp it down.
2. Backfill: *the job is insulated!*

Gilsulate—nature's own insulation—is a unique, solidified hydrocarbon that virtually installs itself. Normal pipe-heat (up to 520°F) does the rest—fuses the Gilsulate to the pipe in hours, forming a massive circular solidified sheath.

Gilsulate costs less installed per linear foot *than any other underground pipe insulation*... it's easiest to use... and has been tested in scores of the country's largest and most important installations.

Some additional Gilsulate advantages:

- *3 grades available*—220° to 520° F
- *needs no sleeves* or mechanical sheaths
- *requires no mixing* or special handling
- *can't be punctured* — leave rocks in backfill
- *pipe expands and contracts* within Gilsulate structure
- *proved in actual use* in hundreds of new construction and replacement installations

Send coupon for descriptive literature.

AMERICAN GILSONITE COMPANY
SALT LAKE CITY, UTAH
Affiliate of Barber Oil Corp. & Standard Oil Co. of California

No skills necessary—simply pour Gilsulate out of 100 pound bags, tamp and backfill. Can be used under any and all conditions—no matter how many pipes, whatever the space.

GILSULATE®

THE TRIPLE-ZONE INSULATION
FOR LIFETIME PROTECTION
OF HOT UNDERGROUND PIPES.

American Gilsonite Company
134 West Broadway, Salt Lake City 1, Utah
or 1145 East Jersey Street, Elizabeth 4, N. J.

Please send me descriptive literature on Gilsulate.

NAME .....

TITLE .....

COMPANY .....

ADDRESS .....

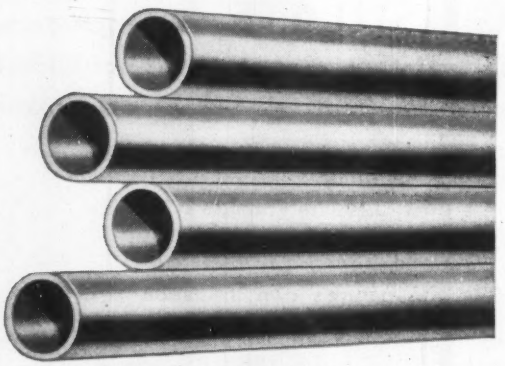
HPC

You're sure of UNIFORM HIGH QUALITY

SEAMLESS • PRESSURE • MECHANICAL

CARBON STEEL TUBES

when you specify GLOBE



SIZE RANGE — WALL THICKNESS

Globe seamless carbon steel tubes are available in a size range of ½ inch to 7½ inches O.D.; wall thickness of .028 to 1.000 inch.

APPLICATIONS

Globe Pressure Tubes are used for boilers, condensers, heat exchangers and process equipment. They meet most exacting demands of modern high pressure and high temperature installations. Globe Mechanical Tubing (seamless) is produced by piercing solid billets. It is an ideal material for low-bearing structural members and parts where strength with minimum weight is needed. Its economy for the manufacturing of many machine parts is universally recognized.

Globe seamless carbon steel tubes are furnished to standard specifications in low and medium carbon ranges.

WHEN you specify Globe you are sure of uniform high quality carbon steel tubes. That's because they are the product of highly developed production facilities and specialized quality controls and methods.

Globe engineers are at your service to assist in the selection of tubing of the exact characteristics you require.

GLOBE TUBES

GLOBE

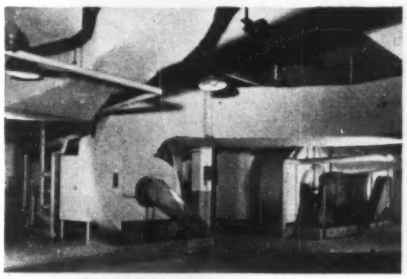
STEEL TUBES CO.

MILWAUKEE 46, WISCONSIN

Chicago • Cleveland • Philadelphia • St. Louis • New York • Detroit • Denver • Houston • San Francisco
Glendale, Calif.

Producers of Globe seamless stainless steel tubes — Gloweld welded stainless steel tubes — alloy-carbon seamless steel tubes — Globeiron (high purity ingot-iron) seamless tubes — Globe welding fittings.

OAKWOOD HOSPITAL — Architects: Stanton & Hillier. Consulting Engineer: George Wagschal Associates. Building Contractor: W. E. Wood Company. Heating Contractor: Page Plumbing and Heating Company.



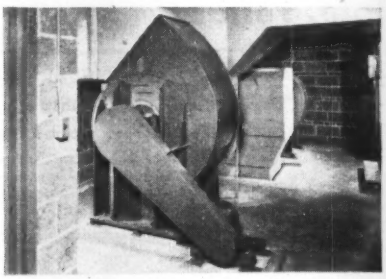
American Blower primary and secondary fans supply heated air to rooms, offices, dining room, kitchen and corridors. Surgery, with its precise requirements for specially conditioned air, also depends on American Blower equipment. The kitchen unit relies on an American Blower sprayed coil dehumidifier.

"Ventilation was a major factor in planning for the health and comfort of our patients"

— FRED BECHTOL, BUILDING SUPERINTENDENT, OAKWOOD HOSPITAL

Air handling equipment in a modern hospital must be dependable and quiet in operation. The health and comfort of the patients demand it. At Oakwood Hospital, $5 million medical center in Dearborn, Michigan, American Blower air handling equipment was specified.

Fred Bechtol, Building Superintendent, appreciates the way American Blower equipment is built to run continuously at rated capacities, with no breakdowns and minimum maintenance expense. American Blower engineers welcome the opportunity to cooperate with you. If you have an air handling problem, give your nearest American Blower or Canadian Sirocco Office a call.

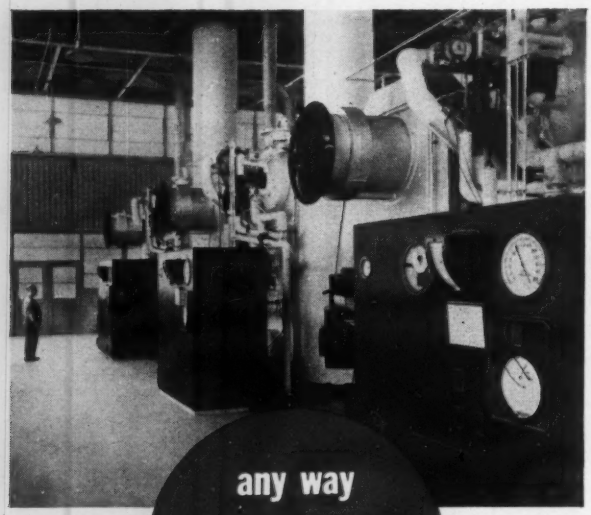


Proper balance of air between supply and exhaust is air handling equipment's biggest job. Oakland Hospital used a total of 10 American Blower HS fans (two are shown here) to handle air exhaust.

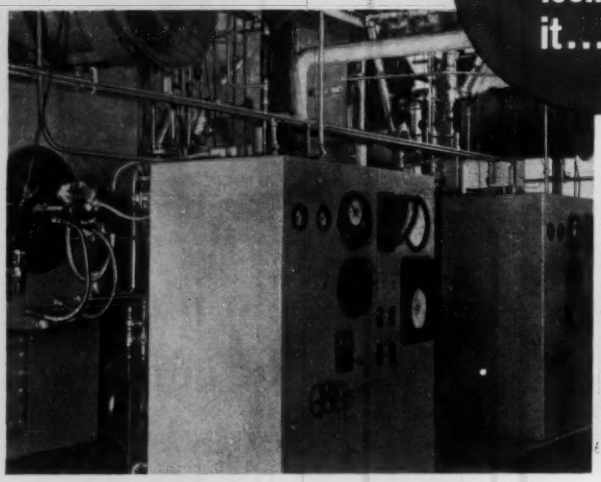
AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO
Division of American Radiator & Standard Sanitary Corporation

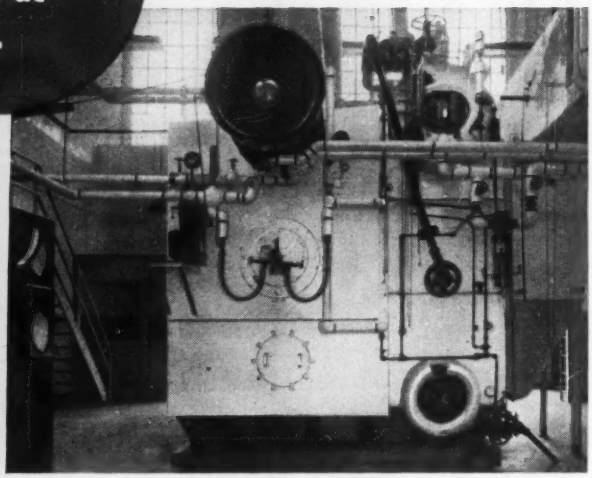
YOUR BEST BUY AMERICAN BLOWER AIR HANDLING EQUIPMENT

Serving home and industry: AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS • SUNBEAM AIR CONDITIONERS



any way you look at it...





The B&W Integral-Furnace Boiler, Type FM

is compact, portable, simple, reliable

Almost one and one-half million pounds of steam capacity for building heating and allied services already have been credited to the B&W Integral-Furnace, Type FM. This shop-assembled unit, for steam loads between 2900 and 28,000 lb per hr at pressures to 235 psi, enjoys such wide popularity with users in a broad range of industrial, commercial, institutional and other classifications that, today, FM Boilers are in service or on order for a total steam capacity of more than 7,000,000 lb per hr.

Automatic control and efficient handling of variable loads are among the many features of this versatile B&W steam generator. The unit is easy to install, and is delivered complete with firing equipment for oil or gas, ready to skid or lift into position, hook-up and place in operation.

The Type FM Boiler has proved to be ideal for small to medium-sized installations where operators have additional duties . . . even for larger installations, two or more Type FM Boilers often are selected instead of large boilers requiring complete field erection and close operating supervision.

COST-SAVING FEATURES

- Saves Erection Time and Cost
- Meets Wide Range of Service
- Handles Quick Load Changes
- Fast Steaming
- Low Maintenance
- Easy Accessibility
- Burns Oil and/or Gas
- Saves Fuel
- Saves Space
- Safe, Automatic Operation

Write for Bulletin G-76B, which details the cost-saving features of the B&W Integral-Furnace Boiler, Type FM. The Babcock & Wilcox Company, Boiler Division, 161 East 42nd Street, New York 17, N. Y.

BOILER DIVISION

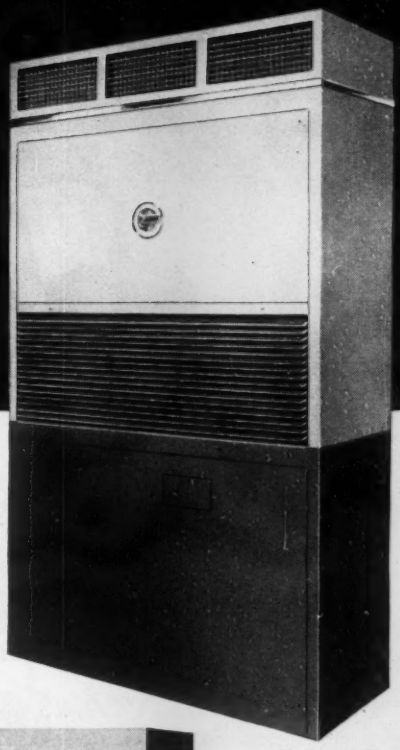
BABCOCK & WILCOX

G-630

1 *of the many reasons why you will find it pays to sell Chrysler Airtemp*

Advanced Engineering which offers your prospects

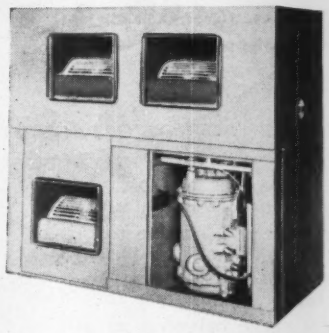
features that DO more!



• The originator of "Packaged" Air Conditioning has always been steps ahead in engineering features which mean more to the prospect because they *do more* for him. The famous Chrysler Airtemp radial-design compressor operates more efficiently and more quietly. "Maxi-Fin" Coil steps up cooling efficiency. "Airfoil" Grille provides a greater range of adjustments of the air flow pattern. And so, right down the line, every one of the many exclusive features of a Chrysler Airtemp "Packaged" Air Conditioner conveys a definite benefit to the buyer.

There are more reasons, too, why you will find that it pays to sell Chrysler Airtemp—the "Packaged" Air Conditioning which most people buy (according to the 17-year sales record). Take a minute now to check those reasons stated below. Then fill out and mail the convenient coupon for complete details of your opportunity to make more money with Chrysler Airtemp—the first name in "Packaged" Air Conditioning.

"Packaged" Air Conditioners in six water-cooled models from 2 to 15 H.P.



New "Packaged" Air-Cooled Air Conditioners— no water needed, no plumbing required. 2, 3 and 5 H.P.

Guaranteed by Good Housekeeping

7 *more advantages you sell with when you sell Chrysler Airtemp...*

★ **Consumer Confidence**—people know the Chrysler Airtemp name—associate it with engineering leadership—have confidence in the products which carry it.

★ **More Units in Use**—Chrysler Airtemp pioneered "Packaged" Air Conditioning in 1937, has more units in use today than any other manufacturer.

★ **Lower Installation Cost**—super-quiet operation permits use within or very close to areas to be cooled, reducing amount of ductwork required. All units shipped completely factory-assembled and tested.

★ **Assured Dependability**—all units manufactured to exacting standards of precision in a windowless, completely air conditioned factory. Each unit is thoroughly inspected and tested, using special equipment and methods, to assure dependable performance in the field.

★ **More Complete Line**—9 models meet all requirements.

★ **More National Advertising** to all prospects and specific benefit advertising to individual businesses—the best markets for "Packaged" Air Conditioning.

★ **More Local Selling Helps**—the broadest line of tested and proved local selling helps for dealers.

CHRYSLER AIRTEMP

heating • air conditioning for homes, business, industry

Airtemp Division, Chrysler Corporation, Dayton 1, Ohio

HP&AC-2-54

Airtemp Division of Chrysler Corporation
P.O. Box 1037, Dayton 1, Ohio

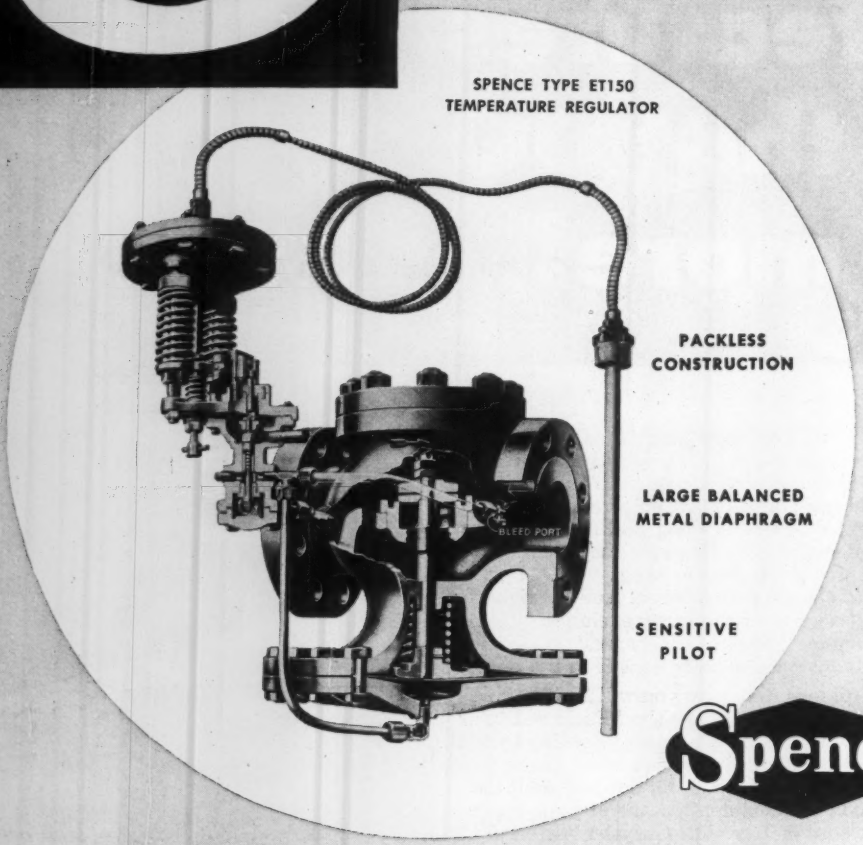
I would like to know more about the Chrysler Airtemp Franchise.

Name_____

Address_____

City_____ Zone____ State_____

3 Reasons for Accurate Regulation



Spence

Packless construction eliminates the need for closely fitted parts that may stick or bind due to dirt or uneven expansion of the parts.

In Spence Temperature Regulators, the Main Valve is actuated by a large balanced metal diaphragm which responds to the slightest changes in temperature.

Sensitive Pilots are designed to limit heater pressure to an adjustable maximum. As the temperature at the thermostat drops a few degrees there is a corresponding increase in steam pressure up to the limit for which the Pilot is set.

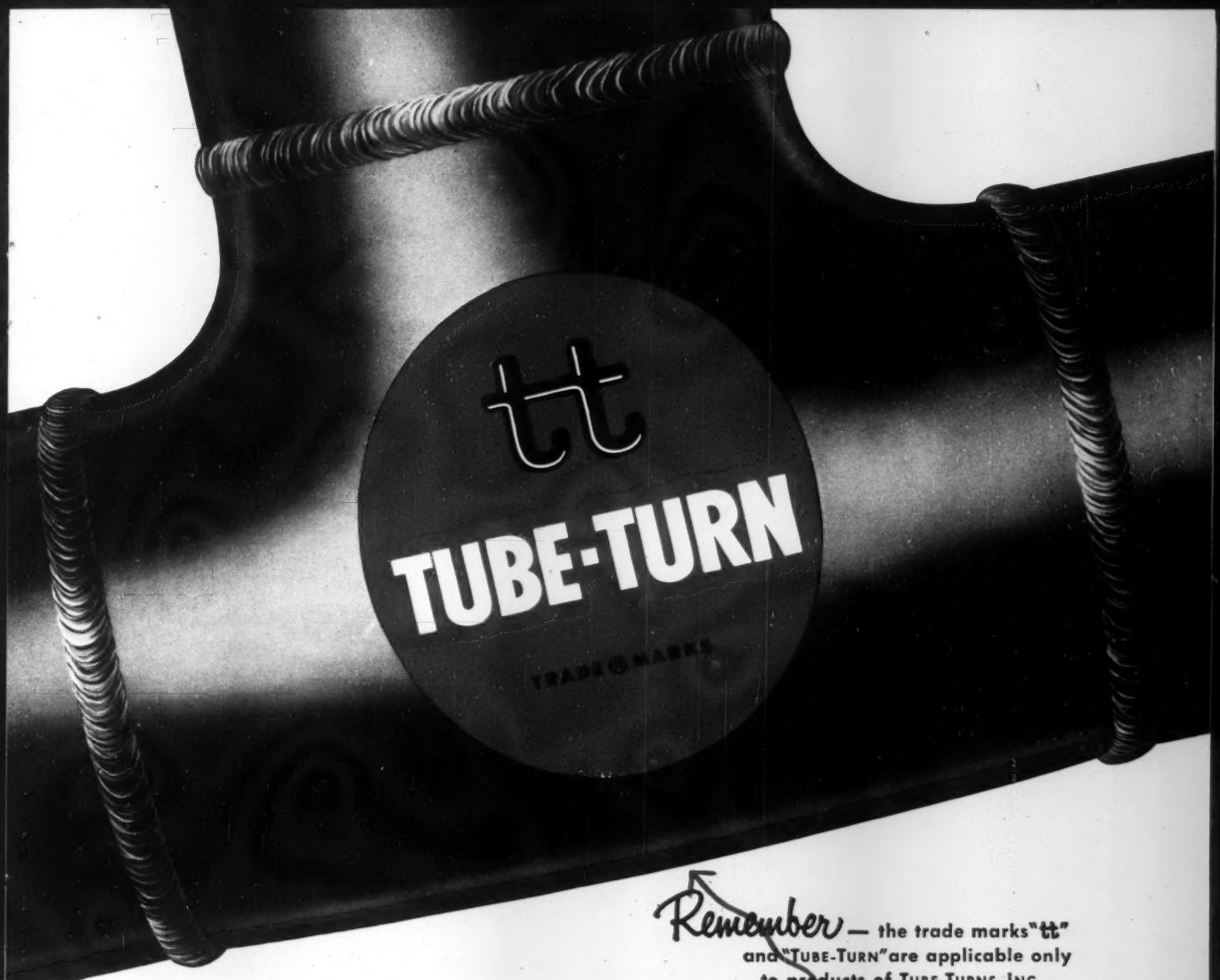
With regulators that respond only to temperature, an increase in load is accompanied by a momentary decrease in steam pressure caused by faster condensation in the heating element. There is a time lag until the thermostat senses the temperature drop and opens the valve wider. Spence Temperature Regulators act like pilot operated pressure regulators when this occurs. They respond instantly to maintain the steam pressure until the thermostat has a chance to further increase it as needed for the heavier load.

These plus other design features explain why Spence Temperature Regulators function dependably and accurately year after year, without requiring extensive repairs or special attention.

Want more facts? Write for Bulletin T50 giving full details.

SE128

SPENCE ENGINEERING COMPANY, INC., Walden, New York



Remember — the trade marks "tt" and "TUBE-TURN" are applicable only to products of TUBE TURNS, INC.

Engineered FOR ENDURANCE

THIS TUBE-TURN WELDING TEE is drawn from seamless tubing to a barrel shape—the form every tee wants to assume under pressure. This design, plus the generous crotch radius and thickness, assure exceptional strength and endurance. In tests of representative fittings, bursting pressures have averaged over 25% higher than required by applicable standards.

This extra quality at no extra cost is typical of all TUBE-TURN Welding Fittings and Flanges. For satisfying service, and to fill all your requirements from one reliable source, get in touch with your nearby TUBE TURNS' Distributor. You'll find one in every principal city.

The Leading Manufacturer of Welding Fittings and Flanges

TUBE TURNS, INC. LOUISVILLE 1, KENTUCKY

DISTRICT OFFICES: New York • Philadelphia • Pittsburgh • Cleveland • Chicago • Denver • Los Angeles • San Francisco
Seattle • Atlanta • Tulsa • Houston • Dallas • Midland, Texas

Subsidiaries: TUBE TURNS OF CANADA LIMITED, CHATHAM, ONTARIO • PENNSYLVANIA FORGE CORPORATION, PHILADELPHIA, PA.

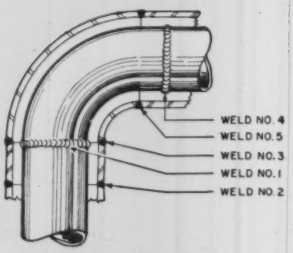
ENGINEERING SERVICE

TUBE TURNS' ENGINEERING SERVICE

develops new method of fabricating jacketed fittings

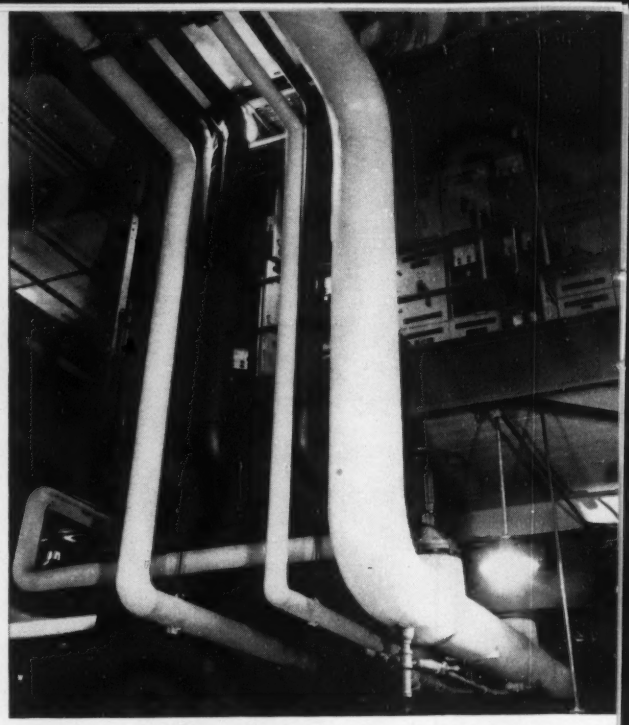
FABRICATION TIME AND COST can be reduced with this method of using welding fittings for directional changes in jacketed piping systems. The jacketed fitting combination consists of long and short radius TUBE-TURN Welding Elbows, with center-line radii closely matching. A tangent on one end of the inside elbow (see cut) extends beyond the corresponding end of the outside elbow. On the other end a short length of pipe is attached to simplify installation.

The method eliminates the need for steam and coolant jumpers, and also eliminates flanged joints, except where disassembly must be provided for. Insulation can be readily applied. Maintenance costs are sharply reduced, as all joints are permanently leakproof. The assembly provides optimum flow conditions, and minimized thermal problems.



Welding sequence for elbow of jacketed system.

This improved technique is another contribution to piping technology by TUBE TURNS' Engineering Service Division—always ready to help you with special piping problems.



These water, steam, and air lines, using TUBE-TURN Welding Fittings to make directional changes, provide permanently leakproof service. Note compactness of layout, and how neatly insulation is applied.

SERVICE is the middle name of your nearby TUBE TURNS' Distributor. He can help you fill all your requirements from one reliable source. TUBE TURNS, INC. offers the world's broadest line of welding fittings and flanges, in a wide range of types, sizes, and more than 40 different alloys.

Want Piping Information?

TUBE TURNS, INC. is recognized the world over for its leadership, not only in the field of welding fittings and flanges, but as a source of authentic information on piping design.

TUBE TURNS, INC., Dept. A-2
224 East Broadway, Louisville 1, Kentucky

Please send me free copy of Pipe and Fitting Materials.

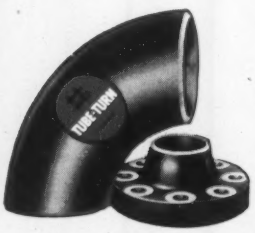
Company Name _____

Company Address _____

City _____ *Zone* _____ *State* _____

Your Name _____

Position _____



DISTRICT OFFICES

New York	Midland
Philadelphia	Tulsa
Pittsburgh	San Francisco
Cleveland	Los Angeles
Chicago	Seattle
Houston	Atlanta
Dallas	Denver

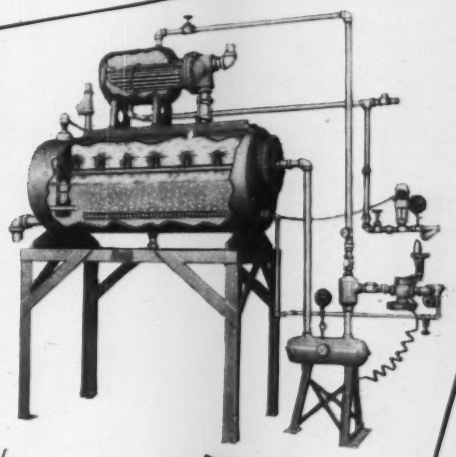
"tt" and "TUBE-TURN" Reg. U. S. Pat. Off.

TUBE TURNS, INC.

LOUISVILLE 1, KENTUCKY

A FRESH LOOK INTO *Deaeration!*

SCHAUB ZERO-OXYGEN *Deaerators*



ENTIRELY NEW

in operating principle
in mechanical design
in the advantages they offer

"Newness" for its own sake is no advantage in a deaerator. But when new thinking achieves improved performance not possible with conventional designs, it's worth looking into!

The Schaub Zero-Oxygen Deaerator differs from all others in that it provides *external* pre-heating to a temperature *above* boiling point, with over-atmospheric pressure held only up to the internal sprayer manifold. The storage receiver itself is *fully vented* and operates at constant, safe atmospheric pressure.

This simple but basic difference opens the way to a whole series of better performance characteristics, including:

LOW OPERATING COSTS
LOW MAINTENANCE COSTS
COMPLETE OXYGEN REMOVAL—(to .005 cc/liter)
COMPLETE SAFETY
WIDE RANGE FOR LOAD VARIATIONS
SIMPLER DESIGN AND OPERATION

The "hows" and "whys" of Schaub Zero-Oxygen Deaerators make an important story for any engineer or operating man concerned with boiler feedwater deaeration. Mail the coupon and we'll send it to you.

FRED H. SCHAUB ENGINEERING COMPANY
2116 South Marshall Boulevard • Chicago 23, Illinois

MAIL THE COUPON FOR BULLETIN 575

Why a deaerating system? How can it save you money and trouble? What makes a good system? How to get maximum benefits at lowest cost? What are some of the engineering factors involved?

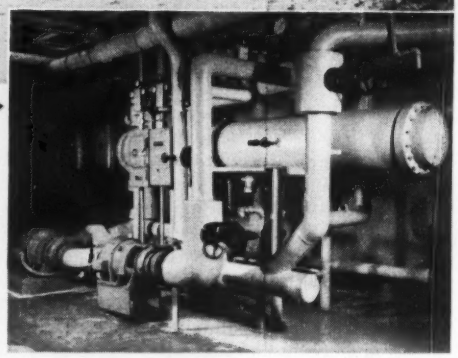
These and many other questions are answered in Schaub Bulletin 575, just off the press. It's a valuable contribution to boiler deaeration theory and practice.

FRED H. SCHAUB ENGINEERING COMPANY
2116 South Marshall Boulevard Chicago 23, Illinois

Please send me, without cost or obligation, my personal copy of your new Bulletin 575 on Boiler Feedwater Deaeration.

NAME.....
COMPANY.....
ADDRESS.....
CITY..... ZONE.... STATE.....

Melting snow automatically is the job of this compact installation, placed in a basement corner of the John Hancock building.



p-k *insures* *John Hancock*

against snow underfoot

Slippery, icy, snow-covered sidewalks are a thing of the past at John Hancock Mutual Life Insurance Company in Boston. Tubing permanently embedded in the sidewalk carries ethelyene glycol solution, heated by a **p-k** snow melting converter. Snow is melted as it falls and drains away.

The **p-k** snow melting converter at John Hancock has capacity to heat 225 gpm of 50% ethelyene glycol solution from 160°F to 180°F with steam at 40 psig., using 976 feet of ¾ in. 18 gauge copper tubing. The system was designed and installed by Buerkel and Company, Inc., Boston contracting engineers.

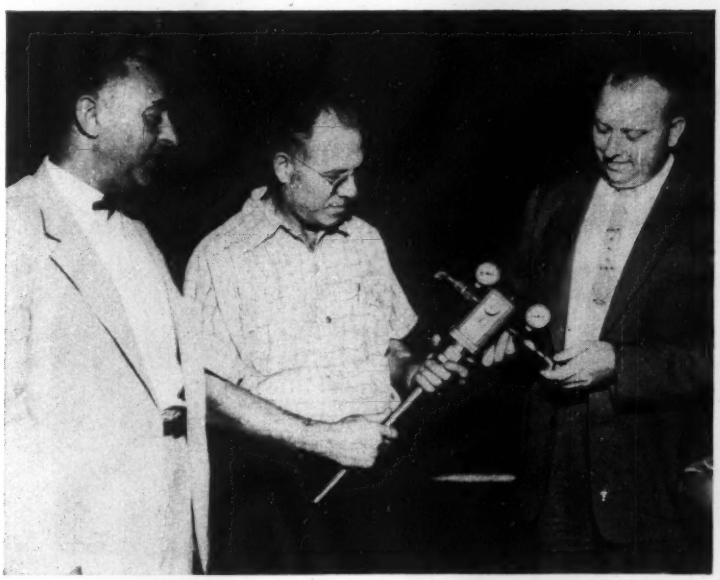
Like the John Hancock Company, you will find sidewalk heating a means of promoting goodwill and increasing foot traffic. At the same time you get *insurance* against damage suits resulting from slippery sidewalks, plus definite snow removal time and labor savings. Write **p-k** now for information on snow melting equipment or any heat exchange problem.

the Patterson-Kelley Co., inc.

720 Burson St., East Stroudsburg, Penn.

1971

101 Park Avenue, New York 17 • Railway Exchange Building, Chicago 4 • 1700 Walnut Street, Philadelphia 3 • 96-A Huntington Avenue, Boston 16 • and other principal cities



CHIEF ENGINEER WILLIAM NOTE inspects the original Leslie Temperature Pilot taken from heater for its first overhaul. Leslie Representatives Frank Riggio (*left*) and Bob Gentner (*right*) look on.

DEWITT O. HESSLER, Laundry's President, joins Chief Note in examination of the original Leslie Pilot before reinstallation.

HOW SHOULD A 21-YEAR-OLD BEHAVE?

Temperature Pilot leads flawless life for 21 years prior to its recent, initial overhaul

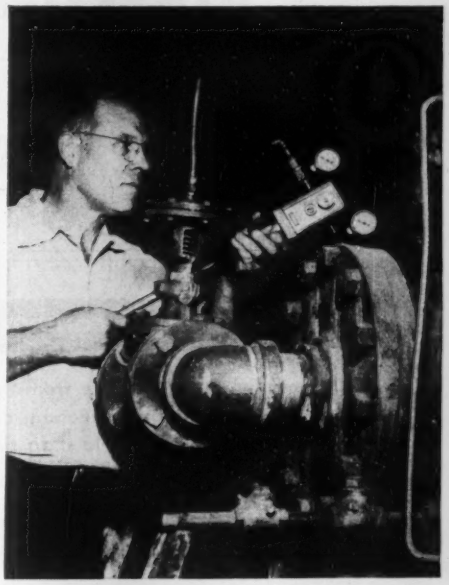
A 21-year-old Leslie Temperature Control Pilot had its "coming-out-party" recently at the Hessler Laundry, Paterson, N. J. The very first one of its kind ever made, it was installed at the Hessler plant back in 1933 by the firm's chief engineer, Bill Note—who also ordered the pilot's first overhaul in 21 years of continuous service.

The pilot was designed to control constant process temperature over extended periods without necessity for recalibration or replacement of thermal elements. The Hessler field test worked out so well that the pilot was left untouched after its initial setting, for 21 years.

Periodic inspections showed the pilot was doing the job without appreciable wear or need for *any* attention. This year, it was removed from the heater for a complete examination and after a quick clean-up, it was put right back into service.

Top performance suggests other applications

The outstanding behavior of this first pilot is being repeated today by Leslie Pilots in hundreds of other applications in all industries. The wide adjustable ranges (32°-400°F and 300°-600°F) make the pilots adaptable to most operating conditions. The fast-responding bi-metallic element responds to changes as small as ¼°F.



CHIEF NOTE REINSTALLS PILOT after *no-cost* overhaul. Parts showed no appreciable wear or corrosion after 21 years of continuous hot water heater service.

Send for Technical Data Sheet 464-14 describing Leslie Temperature Pilots and Controllers.

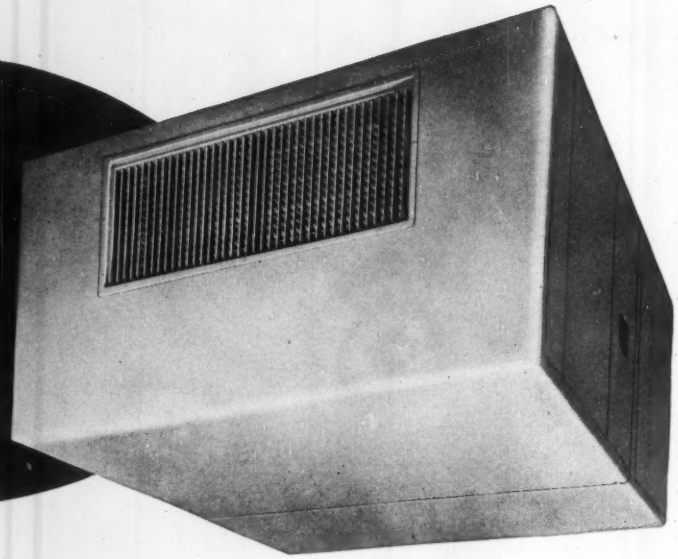
TRADE LESLIE MARK

TOPS IN QUALITY PRESSURE LEVEL AND TEMPERATURE CONTROLS

Since 1900

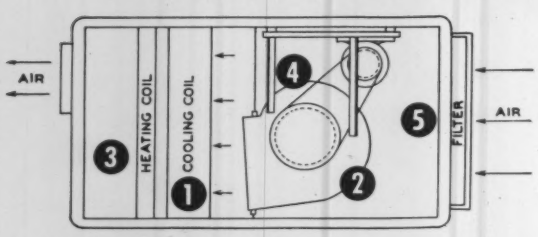
LESLIE CO. 237 Grant Avenue, Lyndhurst, New Jersey

NEW FEATURES of PROVEN MERIT



KRAMER

AIR CONDITIONING UNITS



1 MUGGY-AIR-CONTROL

It "squeezes" extra moisture from the air on muggy days without reheating, dampers or excessive cooling. No short cycling and uncomfortable conditions.

2 "BLOW-THROUGH" DESIGN

Fan-motor assembly always exposed to normal room temperatures. A unique design with many advantages, resulting in —

No motor overload and no loss of bearing lubricant from hot air of the heating coils.

No corrosion of fan-scroll assembly from moisture carry-over of the cooling coils.

3 ANTI-SWEAT CONSTRUCTION

Only a small portion of the casing is exposed to cooled air; that section is heavily insulated.

Access doors and grille have scientific anti-sweat designs.

4 QUIET OPERATION

The fans and motor form an integrated assembly independently rubber-mounted to the casing. All moving parts are completely isolated by rubber.

5 FOR FINISHED INTERIORS

Graceful lines with no unsightly belts, motor and guards exposed to view. Finished in hammer gray enamel.

MANY OTHER OUTSTANDING FEATURES.

WRITE FOR BULLETIN AC-238

KRAMER TRENTON CO. • Trenton 5, N.J.

Here's the

BIG TRUTH*

about boilers...

***You'll make more money selling boilers rated on nominal capacity to operate at "cruising speed" because you'll never have to "make good" a failure.**

KEWANEE

reserve plus rating

guarantees dependability, higher efficiency, lower costs, longer life—because it means "cruising speed" operation.

There's a lot of confusion in sizing boilers today because rating methods have not been brought into the open with a clear-cut definition. That's all changed with Kewanee Reserve Plus Rating. Here for the first time these truths are stated: Only nominal-rated boilers with built-in reserve *safely provide* efficiency—low maintenance—dependability—longer life. Only nominal-rated boilers *safely provide* for fluctuating loads—emergencies—expansion.

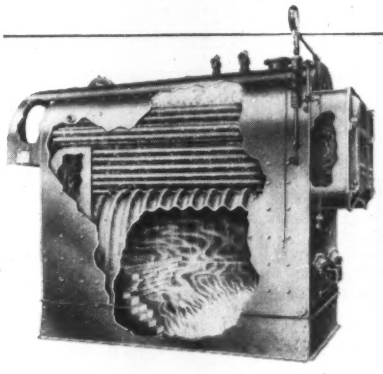
So when you sell or "bid" compare like examples—advocate boiler ratings based on nominal capacity and you'll never have to make good a failure.

Follow the Kewanee Reserve Plus Rating Plan which is based on the commercial code of the Steel Boiler Institute. Kewanee Reserve Plus certifies 50% or more extra power for pick-up and additional capacity. Kewanee gives you complete data and dimensions, so you can realistically consider sizing requirements.

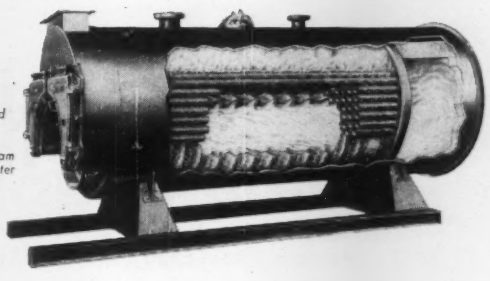
You can count on* KEWANEE *engineering

KEWANEE-ROSS CORPORATION • KEWANEE, ILLINOIS
Division of American Radiator & Standard Sanitary Corporation

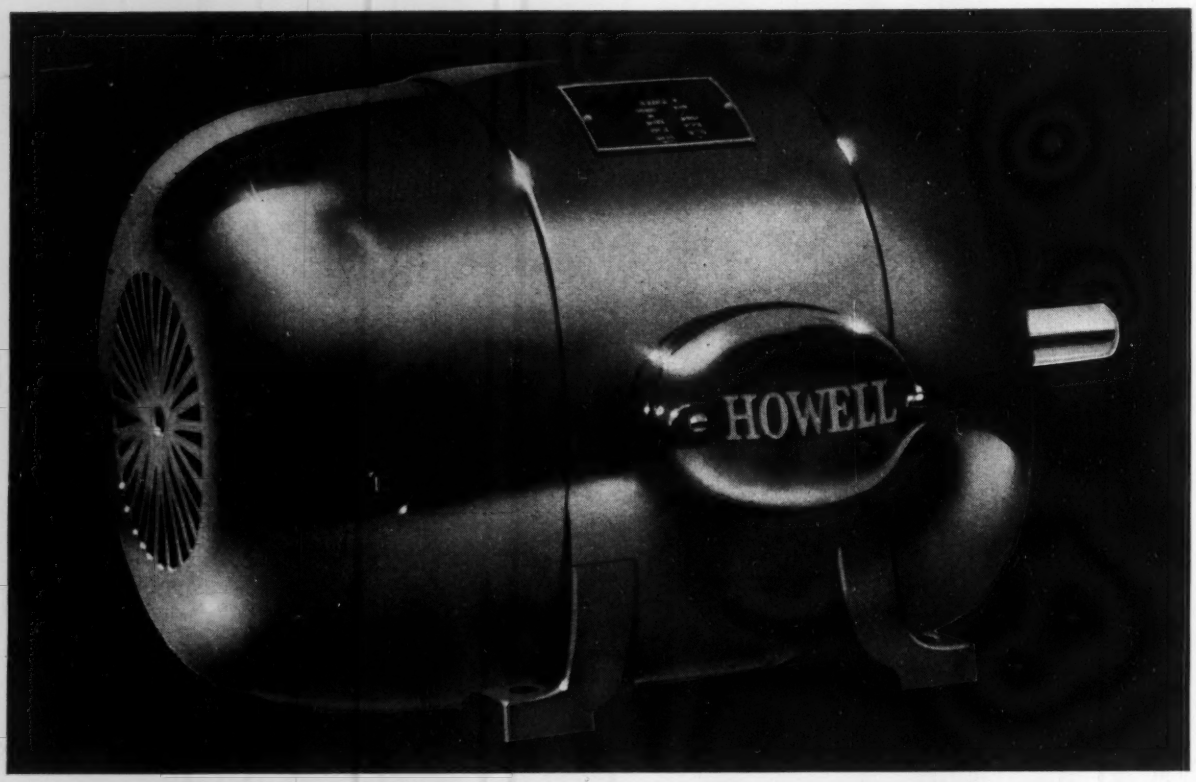
Serving home and industry • American-Standard • American Blower Church Seats & Wall Tile • Detroit Controls • Kewanee Boilers Ross Exchangers • Sunbeam Air Conditioners



Kewanee type "C" boiler
with exclusive corrugated crown sheet. 16 sizes for oil, gas or stoker 3650—42500 sq. ft. steam 5840—68000 sq. ft. water

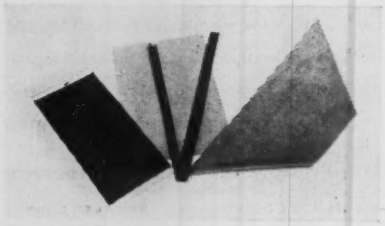


M-800 series boiler
Here is rugged "M-800" Series Scotch Boiler constructed in 13 sizes for high pressure steam 39 to 304 horse power and low pressure 15 lb. steam or 30 lb. water.

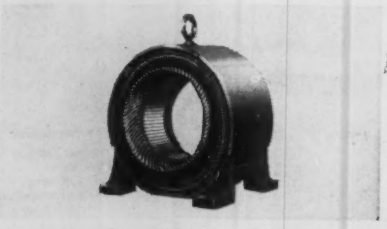


HOWELL FAN-COOLED MOTORS

Totally enclosed, protected against dust, fumes and moisture—the best looking motors your money can buy!



More and better insulation. Each slot cell has seven different pieces of insulation. Top and bottom coils and phase groups are insulated. Howell insulation is unsurpassed in quality.



Improved coil varnish. Type K stators are thoroughly impregnated twice with a phenolic, resin base varnish, and twice baked for unusual protection against moisture, dust, oil, weak acids and mild alkalies.

Howell Type K Motors outperform and outlast any open-type motor. Totally enclosed, all working parts are protected against the destructive action of dust, dirt, fumes and moisture. The fan-cooling prevents motor overheating.

The all-steel, streamlined housing conforms to the most modern trends in machine-tool design and factory layout.

Howell Type K Motors are available in all electrical types, from 1½ to 300 hp. at 1800 rpm., with vertical or horizontal mounting.

For more complete information on Howell's Type K Motors, contact the Howell man in your area, or write the factory for Bulletin K-2.

HOWELL Red Band MOTORS

HOWELL MOTORS

HOWELL ELECTRIC MOTORS COMPANY, HOWELL, MICHIGAN

PRECISION-BUILT MOTORS FOR INDUSTRY SINCE 1915

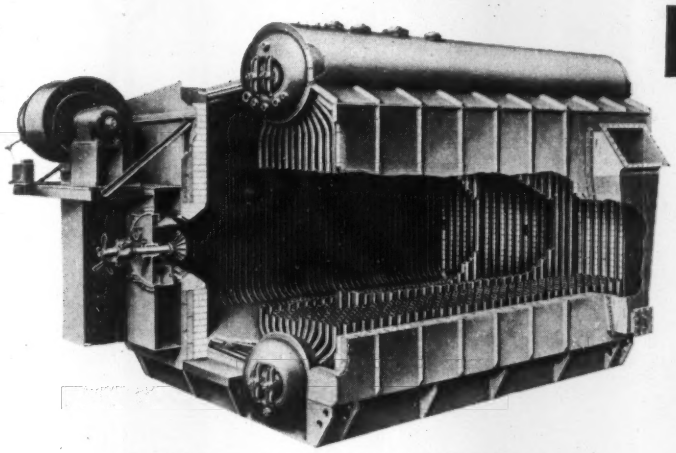
FOR STEAM CAPACITY up to 60,000 POUNDS

Choose your boiler from these two

If you burn oil or gas, investigate the VP Package Boiler for capacities up to 30,000 pounds per hr . . . the VU-10 up to 60,000 pounds.

For stoker firing, the VU-10 is available from 10,000 to 60,000 pounds of steam per hour.

Whatever your fuel . . . whatever your steam capacity requirements up to 60,000 pounds per hour — you'll find that one of the Combustion Engineering Boilers described below will be just right for you.



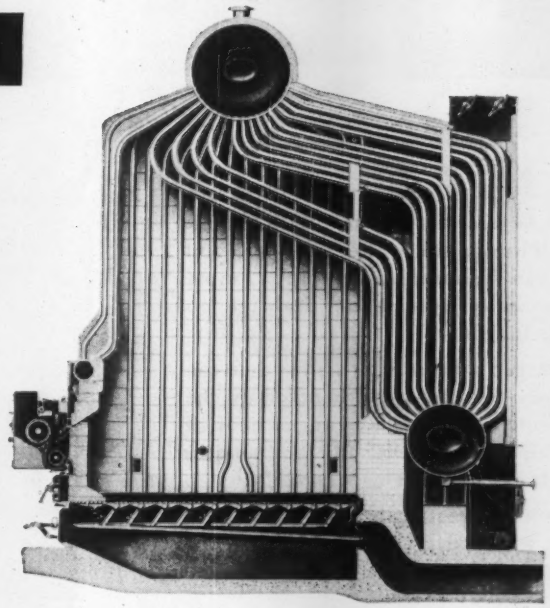
The VP Boiler — the Package Boiler with EXTRA Features

THE VP BOILER

The C-E Package Boiler, type VP . . . completely shop-assembled . . . for oil or gas firing. It is available in capacities from 4,000 to 30,000 lb steam per hr; for pressures to 250 psi. The VP Boiler has more water-cooled area per cubic foot of furnace volume than any other boiler of its size and type. The large (30-in. diameter) lower drum permits a simple, symmetrical tube arrangement . . . greater water storage capacity . . . easy access for washing down or inspection. The centrifugal fan is efficient, yet its noise level is less than half that of typical high-speed blowers used on most package boilers. Baffle arrangement is simple, resulting in low draft loss . . . simple soot blowing . . . elimination of dead pockets . . . high heat absorption.

THE VU-10 BOILER

The VU-10 Boiler is designed for industrial load conditions, particularly for plants with small operating and maintenance forces. Capacities range from 10,000 to 60,000 lb steam per hr . . . pressures to 475 psi . . . heat recovery equipment is available if desired. Fuel can be either coal (C-E Spreader, Traveling Grate or Underfeed Stoker) oil or gas. This boiler is a completely standarized design adaptable to many conditions. It responds readily to variations in load; it is simple to operate and maintain. All parts are easily accessible for inspection. Like the VP, the VU-10 Boiler is a complete unit — boiler, furnace setting, fuel-burning equipment, controls, forced draft — bringing you the benefit of one contract . . . one guarantee . . . one responsibility.



The VU-10 Boiler, as arranged for C-E Spreader Stoker firing

B-689B

COMBUSTION ENGINEERING, Inc.

Combustion Engineering Building • 200 Madison Avenue, New York 16, N. Y.

ALL TYPES OF STEAM GENERATING, FUEL BURNING AND RELATED EQUIPMENT

for better drainage lines

CHASE COPPER TUBE

CHASE

Smooth inside surfaces assure even flow!

Corrosion-resistant, of course!

Entire system lightweight, easily installed!

Fittings trim and compact!

CHASE Copper Fittings are water-tight, pressure-tight!

Chase Copper Tube with Chase Solder-Joint Fittings for waste, vent and soil lines can be installed rapidly . . . more economically...do a better drainage job ...last longer.

You get a *lightweight system* that can be easily assembled and handled on the job. Pipe and joints are rugged enough to take hard knocks. 20 foot lengths need fewer joints.

For complete information, see your Chase wholesaler.

Chase BRASS & COPPER

WATERBURY 20, CONNECTICUT • SUBSIDIARY OF KENNECOTT COPPER CORPORATION

The Nation's Headquarters for Brass & Copper

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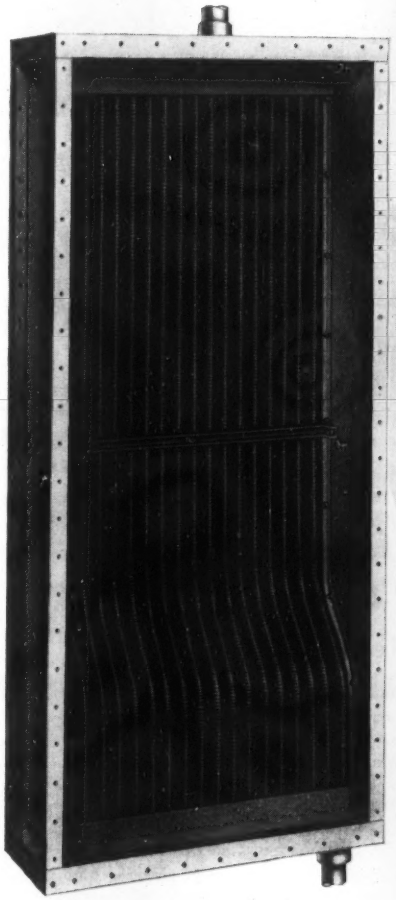
Chicago	Houston	Newark	Rochester†	(† sales office only)
Cincinnati	Indianapolis	New Orleans	St. Louis	

EFFICIENT *Extended-Surface* HEAT EXCHANGERS



for

Heating
Cooling
Process
Air Conditioning

ASK THE AEROFIN MAN

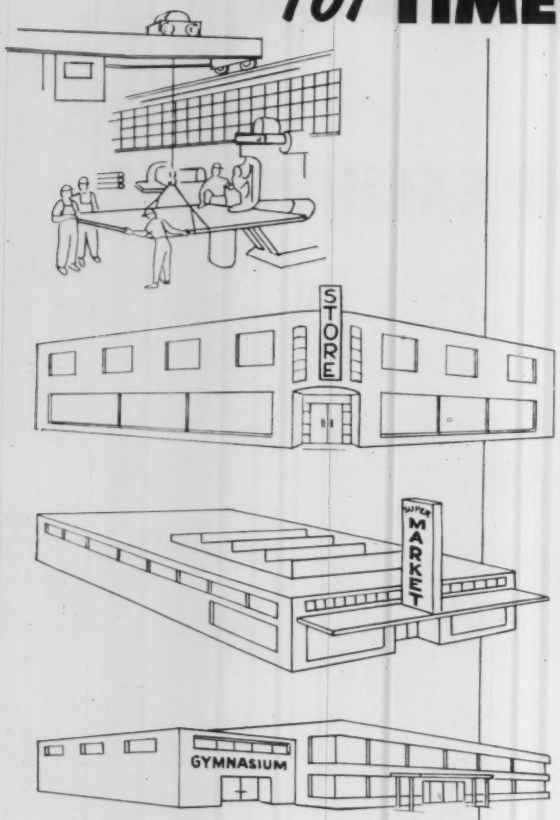
Your Aerofin man's recommendation means high efficiency, long service life, low maintenance costs.

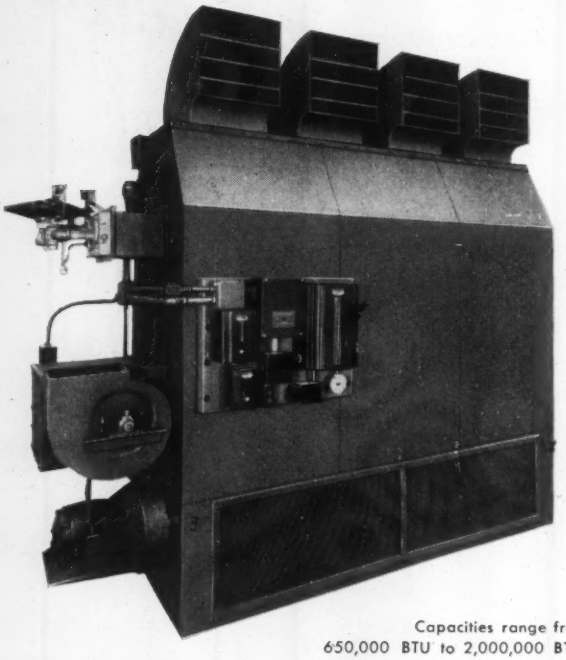
Aerofin's unequalled laboratory and manufacturing facilities — unequalled knowledge of heat-exchange practice — are devoted exclusively to the design and manufacture of highest quality extended heat surface.

Aerofin is sold only by manufacturers of fan-system apparatus. List on request.

AEROFIN CORPORATION
410 South Geddes St., Syracuse 1, N. Y.

Designed for **LONG** *Time Satisfaction for* **TIME-SAVING** *Installation*





Capacities range from 650,000 BTU to 2,000,000 BTU.
*Underwriters' Laboratory Approved.

Airtherm's

Complete, self-contained

DIRECT-FIRED HEATING SYSTEM

Easily installed — simply connect fuel, power and vent stack.

Fuel may be either gas or oil, or combination gas and oil. This combination burner for light oil and natural or manufactured gas provides *instantaneous change-over from one fuel to the other.* This change-over can be made manually with a switch or automatically with an outside thermostat.

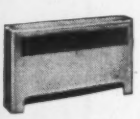
Air to be heated can be either recirculated, drawn in from the outside or a combination of both providing tempered make-up to balance exhaust systems.

Ideal summer ventilation, by simple adjustment of controls, provides a rapid movement of air throughout working zone for personnel comfort.

Compact unit can be placed wherever it is needed, floor mounted or suspended. Tested safety and operating controls assure reliable, automatic operation.

WRITE FOR YOUR FREE COPY OF CATALOG 802B

Compare this flexibility


Convectors

Horizontal Unit Heaters

Vertical Unit Heaters

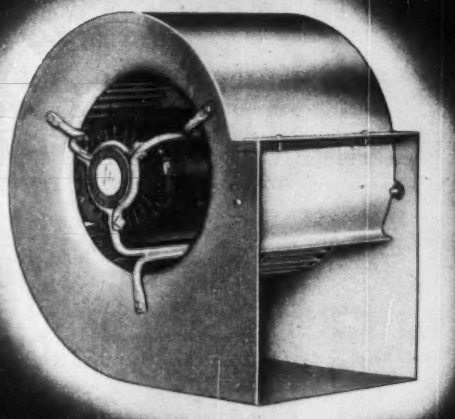
Propeller Fan Unit Heaters

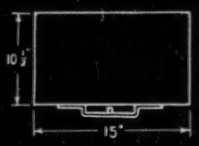
711 AIRTHERM MANUFACTURING COMPANY

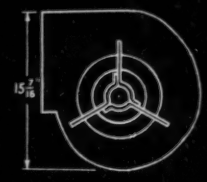
For Heating Satisfaction... Think First of

Airtherm

the newest *Brundage* development . . .







INSTALLS IN ANY POSITION

*ONLY 10-1/2" x 15" x 15-7/16" YET IT DELIVERS 1150 CFM AT .30 STATIC

*Direct Drive Units in higher and lower capacities also available . . . information upon request.

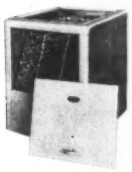
THE *NEW* BRUNDAGE 9" DIRECT DRIVE BLOWER

Here is one case where the biggest value comes in the smallest possible package. Especially designed for air conditioning applications, this new 9" Brundage Blower combines extremely high air handling capacity with a compactness and flexibility to make every cubic inch of your cooling equipment work to its fullest.

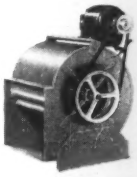
The internally mounted motor not only insures space economy and by eliminating all belts and pulleys, it cuts the cost, ends a major maintenance problem . . . a design simplification that pays dividends in many, many years of superior service. To give you complete freedom in designing your cooling equipment, the 9" Brundage Blower may be furnished with universal mounting legs which allow you to place the unit in any convenient position . . . with full assurance of peak operating efficiency.

Test a Brundage 9" Blower in your own engineering department. Learn how Brundage design, construction and performance can add a new measure of quality to your products. We will be happy to provide everything you need to make a careful evaluation.

Ask about the Brundage production program. It is planned to simplify your inventory problems and free capital which might be tied up in blower stocks.

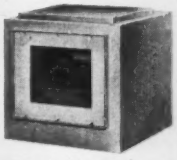


BLOWER-FILTER UNITS



BELT DRIVE BLOWERS

BLOWER EXHAUSTERS



SPECIAL BLOWER CABINET ASSEMBLIES

MEMBER INDOOR COMFORT

"INTEGRITY IS OUR TRADITION"

Brundage COMPANY

PRODUCTS OF CHARACTER

503 NORTH PARK STREET
KALAMAZOO, MICHIGAN

We would like to have further data on:
Direct Drive Blowers ( )
Belt Drive Blowers ( )

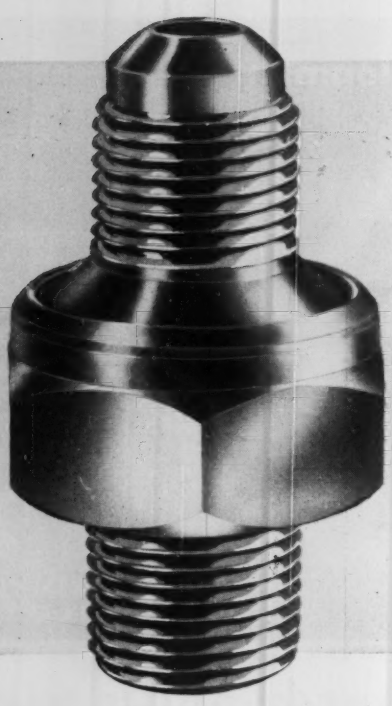
NAME.....

TITLE.....

COMPANY.....

ADDRESS.....

CITY..... STATE.....



This Tiny SAFETY GUARDIAN

Protects Thousands of Air Conditioning and Refrigeration Systems!

Standing only 2" high, this tiny BS&B SEALED TYPE SAFETY HEAD is the silent guardian of thousands of Air Conditioning and Refrigeration Systems now in service. It's there to protect against loss of refrigerant and damage to the system should over-pressure develop.

This low-priced "throw-away" unit provides that important *extra margin of safety* at a very nominal cost, and is standard on several makes of equipment. Assembled and sealed at the factory, it consists of a brass body and a fine silver rupture disc which is designed to rupture at a safe predetermined pressure. When this happens, simply replace it with a complete new unit—quickly and inexpensively—like an electric fuse!

BS&B SEALED TYPE SAFETY HEADS may be used for either primary or secondary relief, and are adaptable to other pressure equipment where brass flanges and a silver rupture disc are acceptable. Guaranteed leakproof! Available in a variety of pressure ratings and connection sizes. Investigate now! Descriptive literature and prices sent on request.

CODE ACCEPTED!

BS&B SEALED TYPE SAFETY HEADS comply with the standards established by the ASA B-9 Refrigeration Code and the ASME Unfired Pressure Code. Many cities are now requiring that air conditioning and refrigeration equipment be protected with safety devices which will comply with these code requirements.

THE "CIRCUIT-BREAKER" OF *Any Pressured System*

SAFETY OVER 60 YEARS BS&B HEADS

Safety Head Division, Dept. 2-DZ2

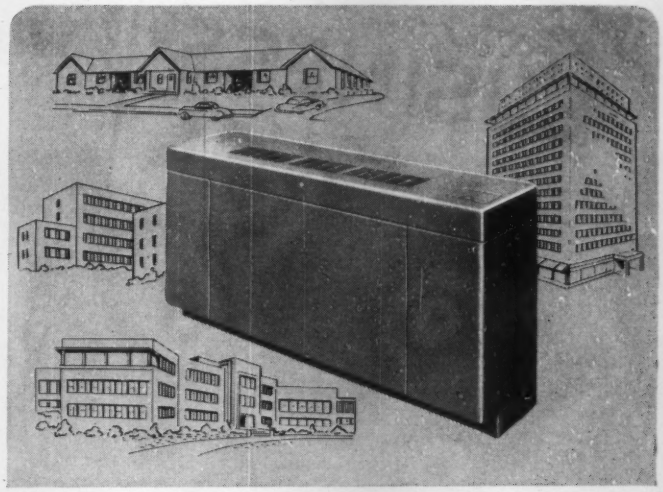
BLACK, SIVALLS & BRYSON, INC.

7500 East 12th Street Kansas City 26, Missouri

Here's the answer to simple, efficient, economical year 'round air conditioning

The REMOTAIRE
by AMERICAN-Standard

a new remote type unit for multi-room installations



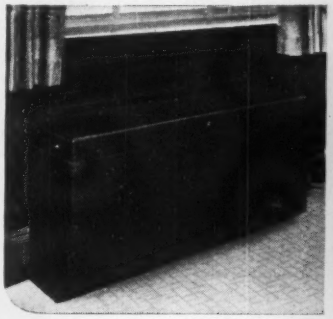
Heats in Winter
Cools in Summer

■ The Remotaire is an individual room remote type unit for providing year 'round air conditioning for central plant multi-room installations.

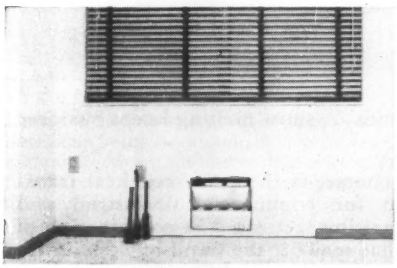
The Remotaire, as part of a Remotaire system, uses chilled water from a central water chiller for cooling and hot water from a central heating plant for heating. Individual control of each unit allows the occupant to choose the room temperature that suits him best without affecting adjoining spaces.

The Remotaire is enclosed in an attractive cabinet of sturdy, reinforced steel—plus a reinforced air grille—which adds to permanence and long-lasting beauty of unit. Designed for location under windows, this unit can be free standing or recessed into wall four inches.

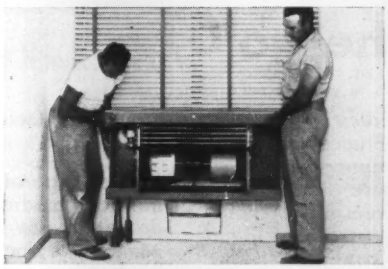
For hotels, motels, apartments, hospitals, offices and industrial buildings and other types of installations.



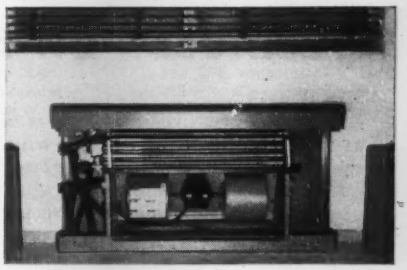
The REMOTAIRE Wall Aperture System is ideal for New Construction



LOCATION READY for Remotaire shows wall aperture, water supply, return, and condensate pipe stubs, and wall plug for electrical connections.



REMOTAIRE is set in place and leveled. Piping and electrical connections are made and pipe insulation applied.



HERE IS THE REMOTAIRE (with panels removed) showing the piping and electrical connections and pipe insulation completed.

As shown in the pictures above, the Remotaire, as part of a Remotaire Wall Aperture System, can be readily installed in the average building since piping connections are the principal installation requirement. Ventilation air is introduced through a small wall aperture behind each unit thus eliminating use of large, expensive, space-consuming ductwork. Other Remotaire systems, using other methods of ventilation, are ideal for modernization as well as new construction. Write for Remotaire Brochure, Form 417.

American Radiator & Standard Sanitary Corporation
P. O. Box 1226, Pittsburgh 30, Pennsylvania

AMERICAN-Standard
HEATING-COOLING

Serving home and industry:
AMERICAN-STANDARD · AMERICAN BLOWER · CHURCH SEATS & WALL TILE · DETROIT CONTROLS · KEWANEE BOILERS · ROSS EXCHANGERS · SUNBEAM AIR CONDITIONER

BUSINESS AS USUAL

with snow melting!

Snow Melting keeps business "on the go"

Many progressive businesses *make their own weather* as far as controlling the all-winter accessibility of their properties is concerned. For thousands of snow and ice removal systems now assure "business as usual," to the foresighted, by preventing interruptions in the flow of commerce once caused by sudden and heavy snows and surface icing conditions.

Yes, steel pipe snow and ice melting systems do eliminate winter weather transportation delays on driveways and sidewalks, ramps, shipping docks and approaches, parking areas, garage and service aprons, and even private spurs and tracks. So in every business where snow and ice are unfavorable factors . . . from service stations and supermarkets to warehouses and factories . . . snow melting keeps business "on the go."

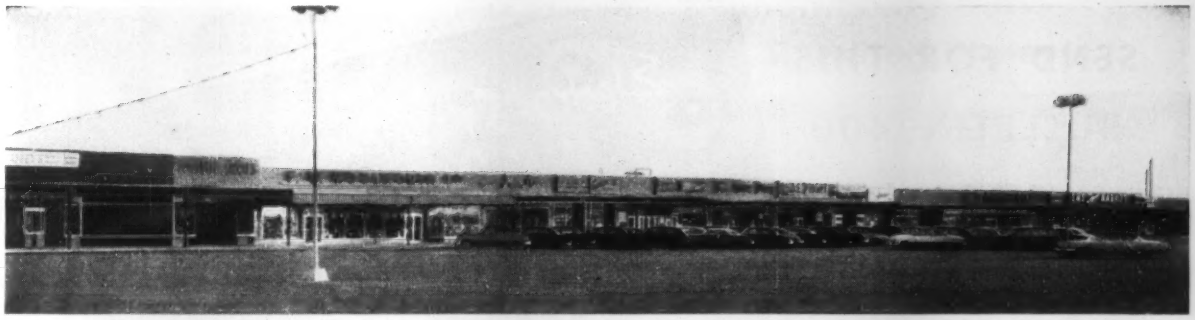
Steel Pipe of course, is the preferred heat transmission medium for commercial, industrial and domestic snow melting systems. The combination of advantages that has made it the stand-by of industry for heating, plumbing, fire sprinkler systems, power, steam and air transmission, for more than 60 years, also makes it ideal for the panels, coils and runs of snow melting systems.

As ever, for snow melting as for other uses, *steel pipe is first choice* . . . the most widely used pipe in the world.

Send for new, free 32 page color booklet "Steel Pipe Snow Melting and Ice Removal Systems."

Steel Pipe is First Choice

COMMITTEE ON STEEL PIPE RESEARCH
AMERICAN IRON AND STEEL INSTITUTE
350 Fifth Avenue, New York 1, N.Y.



MAGIC CITY SHOPPING CENTER in Barberton, Ohio, has over three dozen retail stores plus doctor's and dentist's offices, bank, bowling alley. Many use a heating unit in conjunction with G-E Cooling to provide year-round comfort.

SOLVED: 5 Major Problems in Air Conditioning a Shopping Center

In new $3,500,000 Ohio shopping center, the air conditioning contractor reports that G-E Packaged Air Conditioners saved money, saved space, reduced installation time, cut maintenance... provided amazing flexibility to fit *any* job, *any* situation.

SAVED $10,000 IN ONE APPLICATION.
In one of the largest stores, the contractor reports that installation of G-E Packages made possible savings of about $10,000 compared to the estimate for a conventional central system. Yet these units are operating as a central system with ductwork!

REDUCED INSTALLATION TIME BY 30%.
In both in-space and out-of-space applications, G-E units help cut estimated installation time by almost a third. Savings can be even greater for air conditioning an existing structure!

SAVED VALUABLE FLOOR SPACE.
Builder reports that, in many installations, the application of compact G-E Packaged Air Conditioners increased useful floor area. Some store owners feel G-E units pay for themselves in this way alone!

35% CUT IN ESTIMATED MAINTENANCE COSTS.
No refrigeration lines, seals to check, no motor lubrication needed. Installing contractor Max Weisbrod, of Refrigeration Distributing Co., Inc., of Canton, Ohio, figures savings of at least 35% in upkeep.

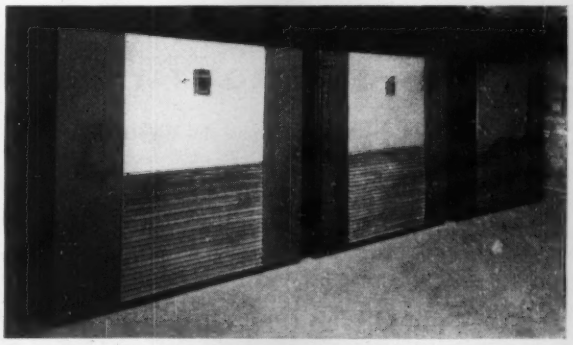
FIT EVERY APPLICATION.
Units are used in-space, out-of-space, on the selling floor, in the basement, in the storeroom, in large stores, small stores, with and without heating units and cooling towers. They range in capacity from 3 to 15 tons with a total of about 450 tons of G-E Cooling in the entire project.

G-E 5-year Warranty big factor in the equipment selection. Factory-sealed and tested, G. E.'s sealed-in-steel cooling unit is so trouble-free that G. E. provides 5 years' protection on the entire refrigeration cycle.

To find out how you can use G-E units profitably, call your G-E dealer today or write to General Electric Company, Commercial Products Department, Sec. HPC-1, Air Conditioning Division, Bloomfield, N. J.

MR. RUSSEL POLAK, who conceived and built this center, says: "We selected General Electric Packaged Air Conditioners because of the large savings gained. Also, the diversity of placement made packaged units more practical for us."

F. W. WOOLWORTH store uses five 7½-ton G-E units in-space for flexibility in placement, absence of ductwork and ease in zone control adjustment.



W. T. GRANT uses three 15-ton units and one 10-ton unit as a central system in the mezzanine with another 15-ton unit in the basement.

Packaged AIR CONDITIONERS
for business and industry

GENERAL ELECTRIC

SEND FOR THIS BULLETIN 400 TODAY!

Electro-Staynew
PRECIPITATOR
THE LATEST DESIGN DEVELOPMENT FOR ELECTRONIC AIR CLEANING
DOLLINGER CORPORATION, 11 Centre Pk., Rochester 3, New York

New Bulletin 400 has information of interest to every engineering department. Keep it handy to answer filtration questions on industrial ventilation.

ELECTRO-STAYNEW BULLETIN CONTAINS...

- detailed diagrams on how the Electro-Staynew cleans air.
- description of all component parts.
- cutaway view of suggested installation.
- complete mechanical and electrical specifications.
- examples of fool-proof safety features.
- report of studies that prove Electro-Staynew sets new standards for economy.
- convenient chart of sizes and material list.

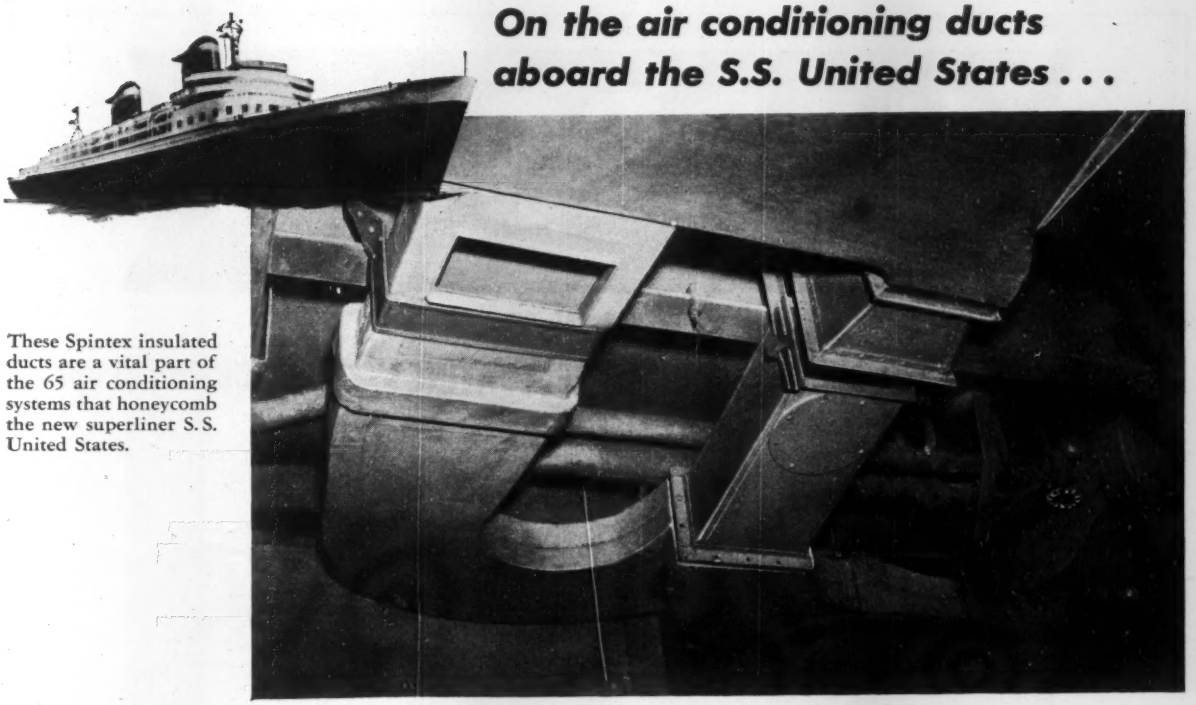
DOLLINGER PROTECTOMOTOR STAYNEW FILTERS

DOLLINGER CORPORATION

9 Centre Park Rochester 3, New York

ALL TYPES OF FILTERS FOR EVERY INDUSTRIAL NEED

On the air conditioning ducts aboard the S.S. United States . . .



These Spintex insulated ducts are a vital part of the 65 air conditioning systems that honeycomb the new superliner S. S. United States.

NEW J-M *Spintex* INSULATION CONSERVES FUEL AND POWER

MILES OF DUCTS . . . a vital part of the 65 air conditioning systems that honeycomb the S. S. United States . . . are insulated with Johns-Manville Spintex. This insulation was selected because it makes possible maximum passenger comfort at minimum operating cost.

Low thermal conductivity . . . plus resistance to moisture, fire, rot and mold growth . . . make Spintex the most effective insulation for guarding against heat transfer and moisture accumulation.

Spintex in flexible and semi-rigid types, plus rigid Rock Cork* and Zerolite*, form a team of Johns-Manville insulations for air conditioning ducts that meet every industrial requirement. Basically mineral products, each insulation has its particular characteristics that make it specially suitable for a specific air conditioning service. All three have the low heat transfer properties needed for high insulating efficiency. Properly installed, these insulations for air conditioning ducts will perform their function effectively for the entire life of the equipment on which they are applied.

Since proper application is so essential to the peak performance of any insulation, Johns-Manville offers industry the services of experienced installation contractors who have made a career of solving complex insulation problems.

J-M Insulation Engineers and J-M Insulation Contractors are conveniently located. They stand ready to combine their talents and give you an insulation job that will pay off your initial investment with maximum fuel savings.

Why not let us send you a free copy of Brochure IN-135A which gives all the facts about Johns-Manville Insulations for Air Conditioning Ducts? Write Johns-Manville, Box 60, New York 16, N. Y. In Canada, 199 Bay Street, Toronto 1, Ontario.

*Reg. U. S. Pat. Off.

Applying Johns-Manville Spintex insulation on one of the ducts aboard the S. S. United States during construction at the Newport News Shipbuilding and Dry Dock Company. Johns-Manville Insulation Contractors throughout the country know Spintex and other J-M insulations as *quality* products, and take pride in applying them properly for peak performance.

Johns-Manville *FIRST IN* INSULATION

MATERIALS • ENGINEERING • APPLICATION

HERESITE

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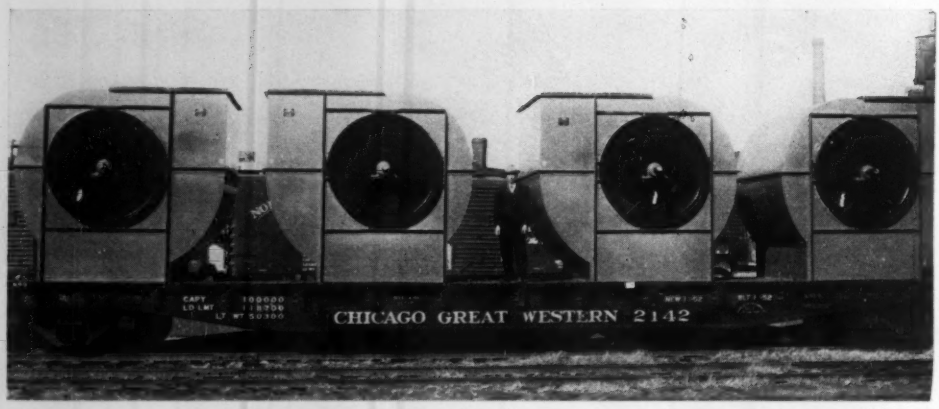
Baking Type **PHENOLIC OIL FREE COATINGS** **Self-Curing Type**



Illustrated above are blowers processed with the HERESITE Industrial Finish which are to be used in connection with sulphuric acid fumes.

Duct systems, blowers, stacks, heating and cooling coils etc. exposed to fumes of most acids can be completely protected with the HERESITE baking type coatings.

Airdry Phenolic Coatings

The VR-500 series coatings provide maximum protection where it is found impractical to apply the HERESITE INDUSTRIAL BAKED FINISHES. Especially suited for masonry surfaces, hoists, monel-rails structural steel and maintenance in general.

HERECROL

REG. U. S. PAT. OFF.

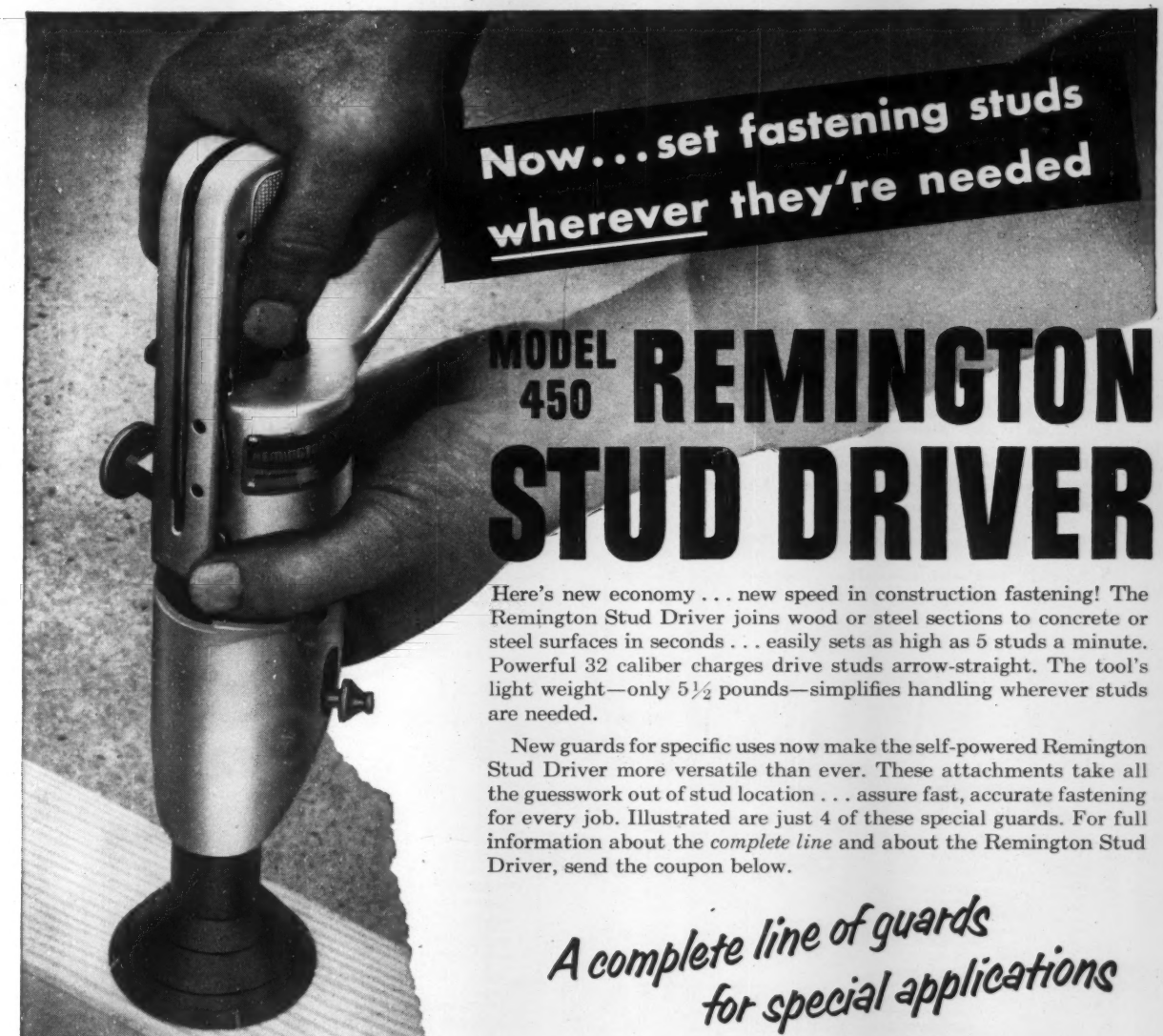
Our SYNTHETIC RUBBER available in SHEET FORM and as a LIQUID COATING for protection of steel.

The HERECROL Synthetic Sheet Rubber is especially recommended for lining steel tanks holding Nitric, Sulphuric and Hydrochloric acid solutions.

HERESITE & CHEMICAL COMPANY

Manitowoc, Wisconsin

Branch Office: 327 South LaSalle Street
Chicago, Illinois.



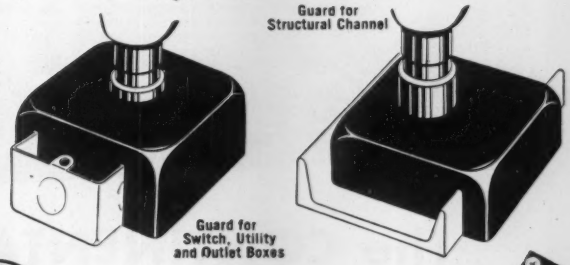
Now... set fastening studs wherever they're needed

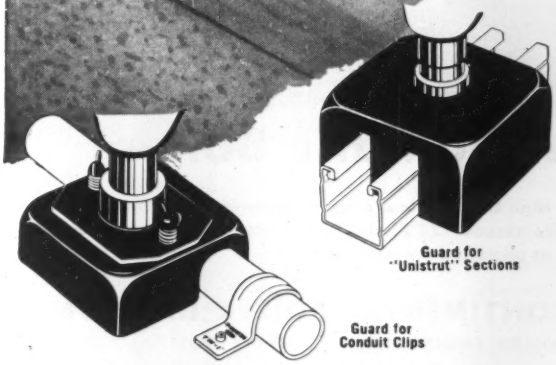
MODEL 450 REMINGTON STUD DRIVER

Here's new economy . . . new speed in construction fastening! The Remington Stud Driver joins wood or steel sections to concrete or steel surfaces in seconds . . . easily sets as high as 5 studs a minute. Powerful 32 caliber charges drive studs arrow-straight. The tool's light weight—only 5½ pounds—simplifies handling wherever studs are needed.

New guards for specific uses now make the self-powered Remington Stud Driver more versatile than ever. These attachments take all the guesswork out of stud location . . . assure fast, accurate fastening for every job. Illustrated are just 4 of these special guards. For full information about the *complete line* and about the Remington Stud Driver, send the coupon below.

A complete line of guards for special applications





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Industrial Sales Division, Dept. HPAC-2
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939 Barnum Ave., Bridgeport 2, Connecticut

Please send me my *free* copies of the new booklets showing how I can cut my fastening costs.

*Name*_____
*Position*_____
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"If It's Remington—It's Right!"

Remington DUPONT

Points to look for when you select a Packaged Boiler:

1 Fiberglas insulation with metal jacket and metallic paint finish.

2 Lift lugs for convenient handling on job site.

3 Boiler shell made of flange quality steel. All joints electrically welded. High pressure shells X-rayed to insure flawless construction and long life.

4 Separator to assure dry steam supply (99%+).

5 Practical front-end construction provides open flow of combustion gases to stack. No refractories to maintain. Entire burner front hinged, providing easy access to fire tubes.

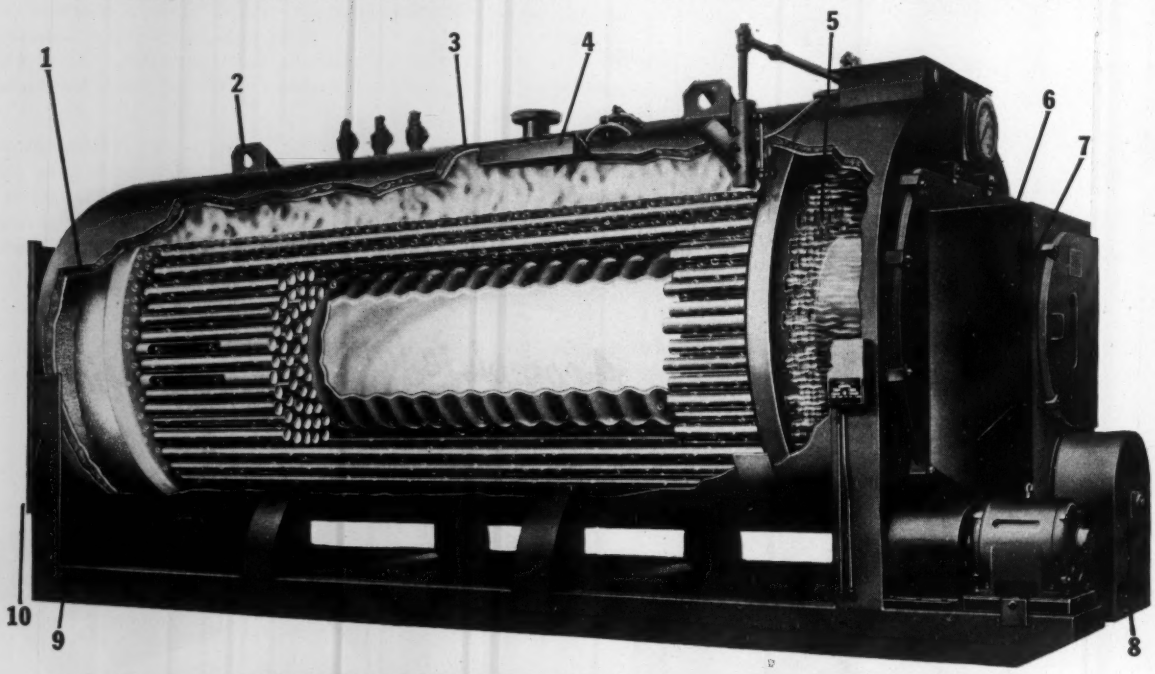
6 Burner and its vital parts—such as fuel nozzles, flame scanner and ignition assembly—fully enclosed in steel housing for safe operation.

7 Dual air-flow burner—for oil or gas fuels—precisely fitted to the boiler furnace. Burner specially designed to mix fuel and air for high combustion efficiency. Heat transferred directly to water surrounding the furnace.

8 Air for the burner passes through an inlet silencer to a forced draft fan. Air flow controlled by adjustable dampers.

9 Structural steel base distributes weight evenly on boiler room floor. No special foundation required.

10 Hinged rear door lined with insulating refractory. Door can be opened in a few minutes—affording access to furnace and all return tubes. No need to remove and replace refractory baffles or brick work. Note sturdy hinge construction which insures positive seating of door.



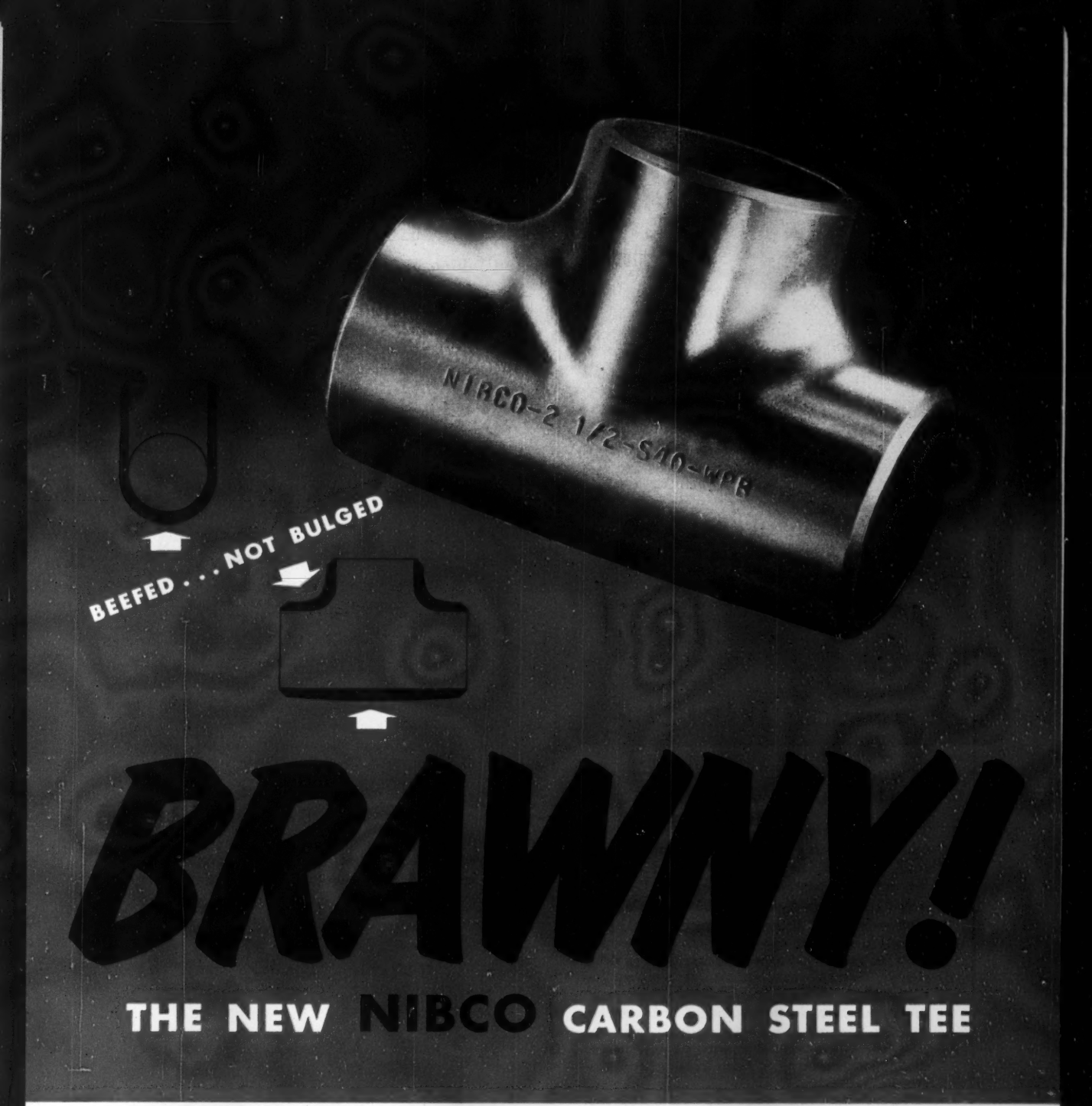
The CONTINENTAL Automatic Boiler

- **Two-pass design—simple and practical. Range 20 to 500 hp.**
- **Factory-tested before shipment. Guaranteed 83% efficiency.**
- **Maximum radiant heat transfer from flame to water-cooled furnace walls.**
- **Even heat transfer—uniform flow of hot combustion gases through all return tubes.**
- **Free and rapid water circulation keeps all heating surfaces clean and improves transfer of heat to boiler water.**
- **High CO_2 and low stack temperature—guaranteed not to exceed 125°F. above saturated steam temperature at operating pressure.**

CONTINENTAL BOILER DIVISION
BOILER ENGINEERING & SUPPLY COMPANY, INC.
1000 Manavon Street • Phoenixville, Pa.

40 YEARS OF BOILER MANUFACTURING EXPERIENCE

CONTINENTAL is sold, installed and serviced by competent distributors throughout the U.S.



BRAWNY!

THE NEW NIBCO CARBON STEEL TEE

All NIBCO Welding Tees meet
A. S. A. Specification B16.9-1940

NIBCO

Controlled cold-flow of metal makes the NIBCO Tee the strongest point in the pipe line. Walls are reinforced with extra metal thickness where extra strength is needed. NIBCO's exclusive forming operation creates a denser grain structure that makes the tee stronger and more resistant to corrosion. Look for the distinctive "Brawny" shape, the smooth unrestricted passages and the beautiful cold-formed finish. They're your clues to superior performance in NIBCO "Brawny" Carbon Steel Welding Tees. You can get them through your regular source of supply.

NORTHERN INDIANA BRASS COMPANY, 271 Plum St., Elkhart, Indiana

904 cooling fills the bill better for you and your customer

The 904 built real sales and profits before, for many heating and air-conditioning men. And, now, you can expect even more — from the new, redesigned 904!

It's still a self-contained cooling unit complete with blower — in 2, 3, 5, and 7½-hp sizes. It's ideal for commercial establishments, such as grocery stores, barber shops, drug stores, restaurants, etc. — as well as for radiator- or radiant-heated homes. But now, in addition, it can be equipped with a steam coil for heating as well as cooling. As in the past, the 904 is available with provisions for duct connections, or with return and discharge grilles.

There are other ways the 904 gives you more in '54: It has pleasing, modern styling by Brooks Stevens, world-famous industrial designer. It has a new, handsome, smooth finish — Mountain Spring Green. All in all, it's everything you'd expect from the Big Name in Heating and Cooling.

Write for further, detailed information.

D-161

97th Anniversary

Mueller Climatrol

2023X West Oklahoma Avenue • Milwaukee 15, Wisconsin

EQUIPMENT DEVELOPMENTS . . .

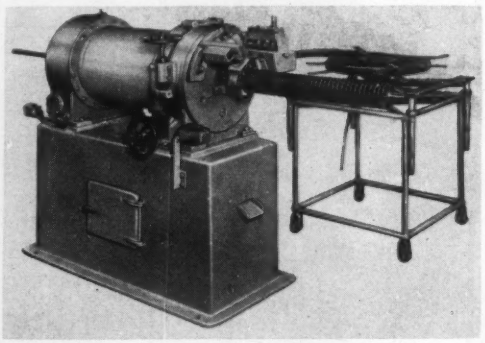
[*Continued from page 172*]

temperature does not exceed 800 F and when the shape and weight of the dust particles are such as to make mechanical separation practicable.

Manufacturer—A. S. Banister Co., Inc., 23 Charles St., Cambridge 41, Mass.

Finned Tubing Machine

A new feature of a tube finning machine for producing continuous finned tubes from ¼ in. up to 4 in. diameter stock is that any of the following combinations of metals can be used. . . . Combinations include aluminum fins on aluminum tubing, iron on iron, copper

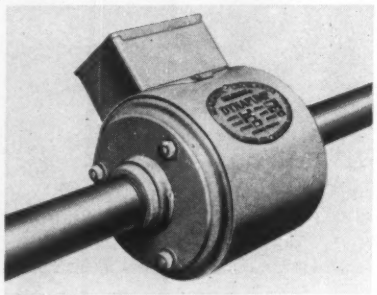


on copper, brass on brass, copper on brass, or copper on aluminum. The machine is so designed that metal tubes of any length may be inserted in one end and the finned tubes come out the other end ready for use.

Manufacturer—United Machinery Sales Co., Dept. PL, 2351 N. St. Louis Ave., Chicago 47.

Magnetic Pump for Circulator Applications

"Dynapump," magnetic pump for circulator applications. . . . This new circulator is said to be quiet and has no shaft seal or motor bearings to require service, according to the manufacturer. The compact unit



is designed to give high heads of 24 ft so that it is adaptable for radiant and baseboard heating jobs. The manufacturer states that since all pump parts are of corrosion-eliminating stainless steel, it is suitable for either fresh or closed water systems. The one standard unit accepts interchangeable flanges from ¾ to 1-½ in.

Manufacturer—The Fostoria Pressed Steel Corp., Fostoria, Ohio.

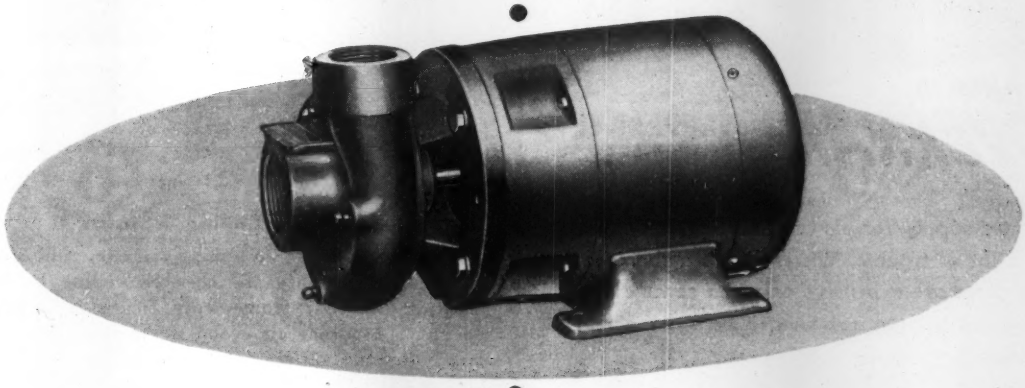
Conditioner for Casement Windows

Compact, ½ hp air conditioner designed especially for casement windows. . . . Developed in co-

high efficiency

The Ingersoll-Rand MOTORPUMP

the most talked about pump in the air conditioning industry



Advanced design by Ingersoll-Rand gives you . . .

LOW FIRST COST—Designed for higher efficiency, I-R Motorpumps often permit use of *lower* hp pumps to handle jobs normally requiring larger size regular pumps!

HIGHER EFFICIENCY—Tests prove these pumps to be among the most efficient units on the market today!

SPACE SAVING I-R MOTOR PUMPS—Compact, light-weight, require minimum mounting space.

EASY INSTALLATION—Compact design saves extra piping costs. Pumps bolt in any position to floor, wall or equipment. No special foundation needed. No coupling needed, no alignment problem!

LONG, TROUBLE-FREE MAINTENANCE—Put in these rugged pumps and forget them. Motorpumps have been sold for air conditioning service since 1929!

AVAILABLE FOR RUSH DELIVERY—Call the nearest Ingersoll-Rand branch office.

- **SIZES:** ¼ to 50 hp.
- **HEADS:** to 650 ft.
- **CAPACITIES:** 5 to 1800 gpm.

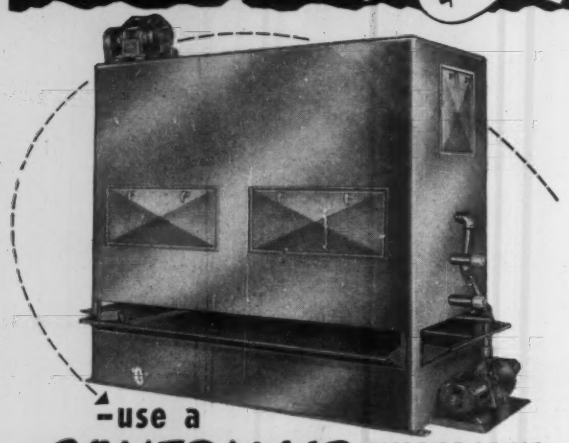
For complete details write for Bulletin.

Ingersoll-Rand

925-9 11 Broadway, New York 4, N. Y.

Low Maintenance

When water is a *Headache...*



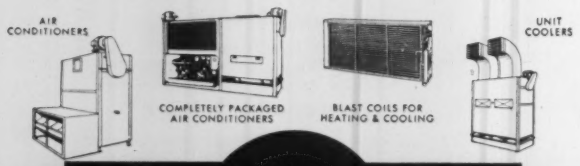
-use a **GOVERNAIR** EVAPORATIVE CONDENSER

Water supply for air conditioning *can* cause you a lot of trouble. When there's a shortage; when rates are expensive or when sewage and piping are impractical—*water becomes a real headache!*

That's when engineers and contractors alike turn to Governair Evaporative Condensers!

Governair Evaporative Condensers eliminate waste-water disposal problems and pumping costs. And they're engineered to give maximum efficiency and performance at a reasonable cost. Available in sizes from 3 to 100 tons.

Choose a Governair Evaporative Condenser and there's no need for aspirin! GOVERNAIR CORPORATION, 513 N. BLACKWELDER, OKLAHOMA CITY, OKLA.



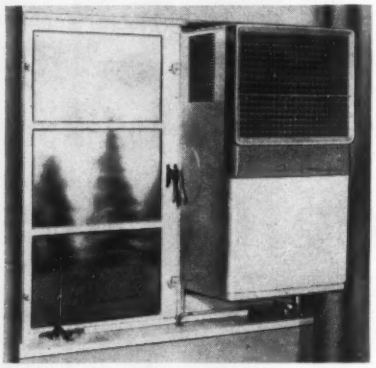
GOVERNAIR

ORIGINATORS OF COMPLETELY PACKAGED AIR CONDITIONERS

EQUIPMENT DEVELOPMENTS . . .

[*Continued*]

operation with the American Window Institute, the air conditioner fits standard size casement sashes and is entirely enclosed within the room. It is bolted to the frame using the same openings provided for storm windows and screens. A molded plastic air discharge grille features movable vanes for directing the air flow. Controls are

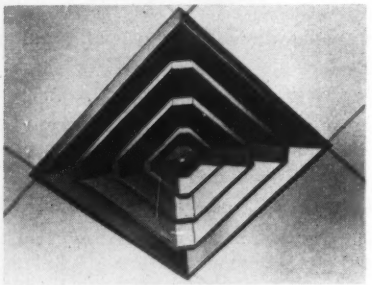


hidden under a plastic cover at the front of the unit. Thermostatic control and a two-speed fan are standard equipment.

Manufacturer—Airtemp Div., Chrysler Corp., 1600 Webster St., Dayton 1, Ohio.

Square, Rectangular Ceiling Diffusers

Square and rectangular ceiling diffusers for installation either on plastered ceiling or for flush mounting in T-bar frame work for acoustical tile ceilings. . . . A corner air scoop is designed to give an adequate quantity of air from the corners as well as the sides of the unit. Models "SFS" and "SFR" have square



and rectangular necks and handle from 125 to 6925 cfm output, the manufacturer states. Models "RSFS" and "RSFR" have round necks and are available in sizes from 5 in. through 18 in. and are designed to handle from 50 to 4420 cfm output. A line of opposed action bladed dampers, splitter dampers and equalizing deflectors are available for all sizes.

Manufacturer—W. R. Carnes Co., Verona, Wis.

Automatic Heating Control

*"Weather Control," designed to automatically regulate the heating of a building through the combination of an inside control panel and an outside weather head. . . . The control times heat to the weather and synchronizes heat output to the actual demands of the

Advertisement

Steam Coils Should be Trapped with Heat-Kwik Steam Traps

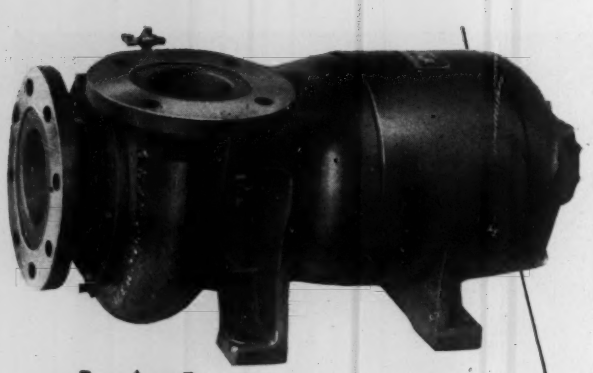
To get quick heating-up of such units as steam jacketed kettles, autoclaves and units with coils, fast air removal is extremely important. The faster the air can be removed from a steam compartment, the faster the compartment becomes filled with steam and the faster the unit will give off heat. Particularly where steam is turned on and off frequently, fast heating-up time reduces production costs. The quicker the unit heats up, the faster the production cycles, which means more work can be obtained from a unit during a given work day. This of course, substantially lowers the over-all production costs. But even where production cycles are not involved, fast air removal is important if you want to stretch your plant's fuel as far as possible. Heat-Kwik Steam Traps, with their fast air venting ability, fulfill the requirements of quick air venting and should be used on all units with steam coils.

Select Steam Traps That Can Be Readily Inspected

Servicing steam traps is often considered a tedious job. If you've ever had to check your steam traps for proper operation or identify those traps which need replacing of valves and seats, you know that the work can be very difficult. Yet, when properly designed steam traps are used, the job can be done very quickly and easily.

Many conventional inverted bucket traps present a servicing problem because they have the inlet and outlet connections in the bottom and top of the trap respectively. This makes it necessary to disconnect piping to obtain access to the trap. Super-Silvertop steam traps have all the pipe connections in the top. The body of the trap is in no way connected up with any piping and can be removed merely by loosening the bolts that secure the body to the head. The trap stays right in the line while you inspect, clean or repair the unit.

HEAT UP
STEAM UNITS
IN 1/8 THE TIME
WITH
Heat-Kwik
Super-Silvertop Steam Traps
Interested in getting more production out of your steam-consuming units? Then equip them with the new Heat-Kwik Super-Silvertop Steam Traps. One of the most important steam trap developments in our times, Heat-Kwiks heat up units in 1/8th the time of ordinary inverted bucket traps . . . three times as fast as so-called air eliminator or blast type traps. Everywhere users are adopting these phenomenal traps as the answer to fast heating up, more production, and lower steam consumption. You, too, can save money by standardizing on Heat-Kwiks. See your Super-Silvertop distributor or mail coupon for further information.
SUPER-SILVERTOPS...
Quality Steam Traps Since 1886
The V. D. ANDERSON Company
1949 West 96th Street • Cleveland 2, Ohio
Please send me a copy of your Bulletin 1153 describing Heat-Kwik Steam Traps.
Name Title
Address
City State
ANDERSON

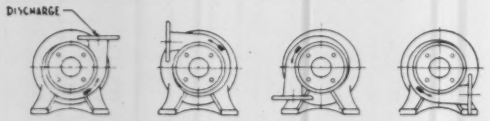


WEINMAN
Close
Coupled
Centrifugal
Pumps

lower in first cost, lower in maintenance cost!

Installation of air conditioning systems is sometimes a tricky business. Space in existing buildings is usually limited, making pump replacement a real problem. WEINMAN close coupled centrifugal pumps are designed to lick this problem, and here's the way they do it:

WEINMAN pumps require less space to begin with. They can be mounted in any position. Note, too, that the discharge can be turned to any one of four different positions.



This means you can mount a WEINMAN pump on the wall, suspend it from the ceiling, bottom or side of a tank, or on the floor . . . important where installation space is limited.

If pumps are a problem that's plaguing your installations, call a WEINMAN Centrifugal Pump Specialist. He has the solution and the pumps, to solve the toughest jobs.

"Centrifugal Specialists"

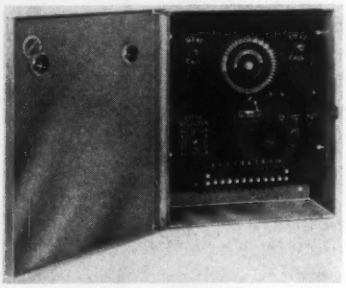
The WEINMAN Pump Mfg. Co.

296 Spruce St. Columbus 8, Ohio

EQUIPMENT DEVELOPMENTS . . .

[*Continued*]

weather. Heat is cycled on the inside control panel according to outdoor temperature and indoor building satisfaction. The weather control starts and stops the heating plant at pre-selected intervals as programmed on the 24-hr dial. For summer use, the "Off" position allows the system to provide hot water without building heating. An



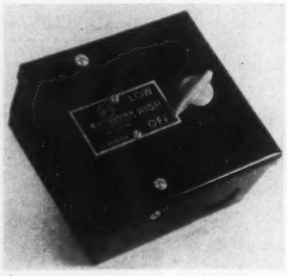
omitting device for automatically skipping days on which buildings are closed is optional equipment. The unit, for line voltage only, is available in 115 volt-60 cycle and 208-230 volt-cycle models.

Manufacturer—Tork Clock Co., Inc., 1 Grove St., Mount Vernon, N.Y.

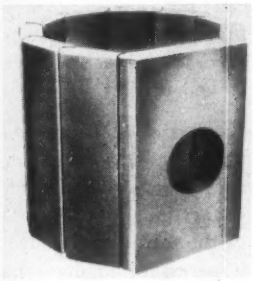
High Combustion Chamber

**New 16 in. high combustion chamber with a capacity of from 0.75 gal to 8 gal and designed to fit all boilers and furnaces. . . . Called the "Kolbkast Universal," it is available in two types, one for temperatures up to 2100 F and the other for temperatures exceeding 2100 F. The manufacturer states that both types have a *K* factor equal to insulating brick. They are available as a complete package including the chamber, steel bands and sufficient castable to cast a 1½-in. thick interior base, or packages of runners and door sections can be purchased.

Manufacturer — Kolb Refractories Co., Meadow & Jackson Sts., Philadelphia 48.



Speed Control



Chamber

Motor Speed Control

**Speed control for fractional horsepower shaded pole motors. . . . The control can be made for three-speed operation and features an air gap design to provide for starting at low voltages and eliminate core saturation. Three models are available: cased control for remote control installations; panel mounted control to permit single hole mounting on panels; and chassis mounted control where it is desirable to mount the control

"...and they can fabricate their tube into the parts we need!"

"And, even more important, fabricated tubular parts cost less money!

"Take the job we had at the plant last week. If we had followed the original suggestions, we would have had to form and assemble three different pieces. But Wolverine gave us a better answer.

"They just took a 6" length of 1½" diameter tube. Using their unique Spun End Process†, they closed one end completely, reduced the other end to ⅜" diameter, added a bead, and there we were."

"I remember the cost sheet. We knocked off 6¢—just about half!"

"That's right! And on this job, where we need to save space, I'm going to suggest Wolverine Trufin*."

"What's that?"

"It's a one-piece finned tube—the fins are actually part of the tube wall—integral, they call it. They can bend Trufin, coil it, fabricate it, just like plain tube."

★ ★ ★ ★

WANT TO SEE IT IN BLACK AND WHITE? Just give us a chance to show you how much we can save in fabricating a tubular part to your specs. And—remember Trufin—it's available in copper, copper-base alloys, aluminum or bi-metal. Write for Wolverine's booklet "Fabricated Tubular Parts" today. WOLVERINE TUBE DIVISION, of Calumet & Hecla, Inc., 1461 Central Avenue, Detroit 9, Michigan.

Wolverine Trufin and the Wolverine Spun End Process available in Canada through the Unifin Tube Co., London, Ontario

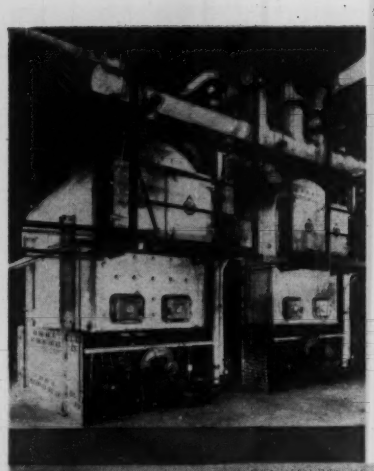
EST. 1916

WOLVERINE TUBE DIVISION
OF CALUMET & HECLA, INC.

Manufacturers of Quality-Controlled Tubing

† A PATENTED PROCESS RE.22465
* REG. U.S. PAT. OFF.

PLANTS IN DETROIT, MICHIGAN, AND DECATUR, ALABAMA. Sales offices in principal cities.
Export Dept., 13 E. 40th St., New York 16, N. Y.



Two NATIONAL Commercial Steel Boilers serve the heating requirements of the entire Waukegan, Illinois plant and office of the Vascoloy-Ramet Corporation. The heating load approximates 70,000 sq. ft. of radiation, equivalent to 16,800,000 Btu per hour. Permanent scaffolding expedites cleaning and servicing.

View showing the recent one-story addition to Vascoloy-Ramet Corporation buildings in Waukegan, Illinois. This new addition houses the central heating plant. A. Epstein & Sons, Chicago, Architects & Engineers; Ralph Swanson Construction Co., General Contractors; William A. Pope Company, Chicago, Heating Contractor; Oil Burner installation by Mid-West Heat Service, Chicago.

Performance *Confirms* Right Decision

NATIONAL STEEL BOILERS

chosen by VASCOLOY-RAMET CORPORATION for modernized central heating system of newly enlarged plant. When Vascoloy-Ramet Corporation, Waukegan, Illinois, recently built a spacious one-story plant addition, the coal-fired National Steel Boiler that had served the existing plant for many years was threatened with too heavy a strain for the extra load required. It was decided to provide a new central boiler room in the plant addition.

Since excellent results had been achieved with the first National Boiler, two new automatic, oil-fired National Commercial Steel Boilers were installed for heating the entire plant—and for supplying domestic hot water for cafeterias, lunchrooms, lavatories and showers. Low pressure steam from the tandem installation is distributed to radiators, convectors and unit heaters throughout the plant and offices.

Going into their second full season of operation, these new National Boilers are living up to expectations and fuel costs are within original estimates. Vascoloy-Ramet Corporation is now sure it made the right decision!

To help you decide right on heating, write for Catalog HP-507 giving full details on National Commercial Steel Boilers.

THE NATIONAL RADIATOR COMPANY
JOHNSTOWN, PA.
Complete heating for homes, commercial buildings and industry since 1894

for Real Heating Comfort go NATIONAL

BRANCH OFFICES:
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EQUIPMENT DEVELOPMENTS . . .

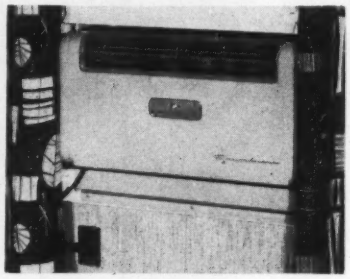
[*Continued*]

reactor within the fan base or blower enclosure. The speed controls are designed for each specific application due to variations in motor types, applications and speed requirements.

Manufacturer—Ballastran Corp., 1701 N. Calhoun St., Fort Wayne 7, Ind.

Flush Mounted Window Conditioners

Window-type room air conditioner with flush window-mounting design. . . . With the new mounting, the air delivery and return section of the air conditioner, plus the controls, show in the room. A metal "tunnel" surrounds the control section, plus each side of the unit at

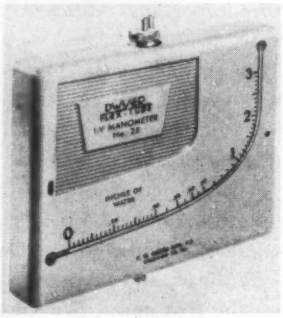


that point. The window is then lowered to a sealing flange on top of the tunnel near the front of the unit. The section of the unit which extends outside is braced with a tubular steel support bar. Four sizes range from ½ to 1 hp.

Manufacturer—Frigidaire Div., General Motors Corp., Dayton 1, Ohio.

Air Filter, Draft Gage

**"Flex-Tube" I-V gage for plus, minus and differential readings. . . . It is claimed that the gage will serve as an air filter gage, static pressure indicator, draft gage, air velocity meter, etc. It is equipped with a plunger type oil level adjuster. Ranges are 0.3 in. and 0.7 in. water

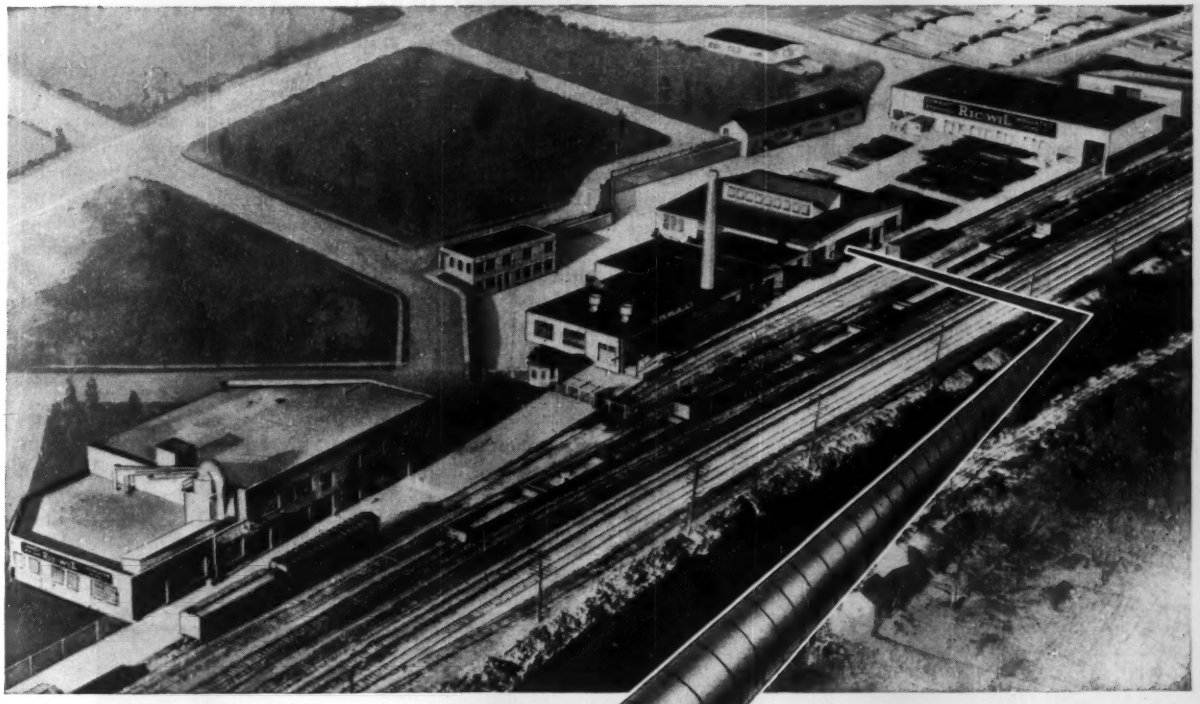


— low range accuracy of 0.01 in. water. It is also available in a direct reading velocity model for use with a pitot tube, ranges 0-7000 and 0-10,500 fpm.

Manufacturer—F. W. Dwyer Mfg. Co., 317 S. Western Ave., Chicago 12.

Offset Fan Blade

A 20-in. offset fan blade designed to reduce the required thickness of assembled air-moving appliances by curling back around a motor instead of pro-



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Quality

The Ric-wil Company represents over 40 years of manufacturing Quality Insulated piping systems. The complete Ric-wil product line is continuously pre-proven by laboratory and field tests to maintain this superior quality.

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Quality Piping Systems of the . . .
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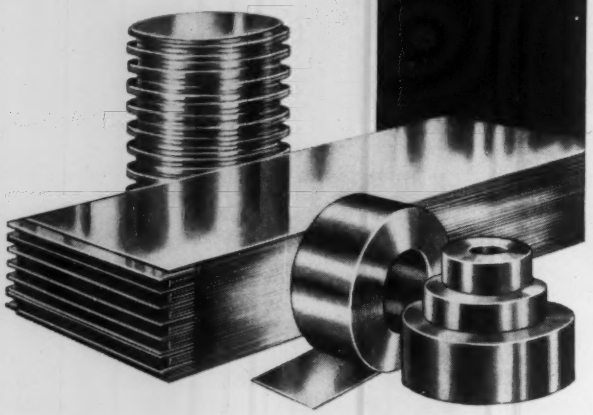
Ric-wil PREFABRICATED **INSULATED PIPING SYSTEMS**

THE RIC-WIL COMPANY
BARBERTON, OHIO

Better Yet,

USE FAIRMONT aluminum



In better parts and accessories for heating and cooling applications, Fairmont 2S, 3S and 52S wrought aluminum sheet is nationally recognized for highest quality and uniformity. Improved appearance, higher thermal conductivity, lighter weight, wear-resistant ductility, and non-corrosive and stain-proof surfaces—all these objectives and more are readily achieved.

Fairmont bright aluminum rolling mill products—sheet, coil and circles are now available for prompt delivery to meet manufacturing schedules.

FAIRMONT ALUMINUM COMPANY

Fairmont, West Virginia

EQUIPMENT DEVELOPMENTS . . .

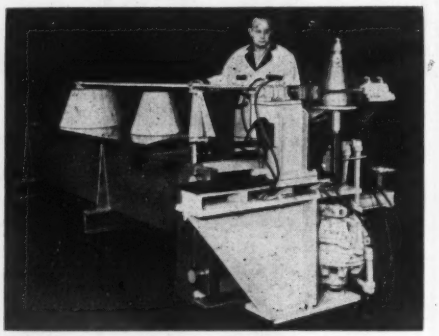
[*Continued*]

truding out from its motor shaft. . . . Known as the "AIRistocrat YO," the fan has a center dimension opening of 6-3/8 in. diameter designed to accommodate all known conventional motors suitable for this type of operation. The three-blade assembled air impeller is made of aluminum blades and a steel spider and hub. The blade is manufactured in various pitches and may be operated in either direction.

Manufacturer—The Torrington Mfg. Co., 70 Franklin St., Torrington, Conn.

Tube Bender

Semi-automatic hydraulic powered machine that makes bends varying from 3/4-in. to 2-ft radius in finned or plain ferrous and non-ferrous metal tubing up to 40 ft long. . . . The machine is designed to bend tubing up to 1-1/2 in. diameter around a cone-shaped steel die that is adjustable both vertically and horizontally to provide bending radii in infinitely variable increments



within the large and small diameters of the cone. Larger bend radii up to 2 ft are attained by nesting hardwood cones of larger sizes over the conical steel die. Four hardwood cones provide the radius range up to 2 ft. The machine has a bending table powered by a high torque, positive displacement, signal vane, one revolution hydraulic motor.

Manufacturer—Walter P. Hill, Inc., 22183 Telegraph Rd., Detroit 19.

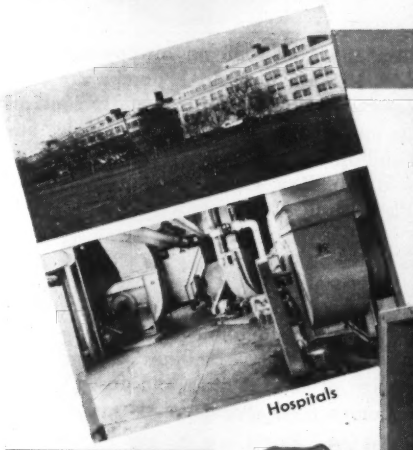
Cycle Welder

New welder designed to further the advances made with the shielded inert gas metal arc process by maintaining stable welding conditions regardless of arc variations. . . . Rectifier type 500 amp cycle welder consists of a coupled three-phase transformer, saturable core type three-phase reactor in the primary circuit, control windings, and a selenium rectifier stack. Remote control, using either a foot or hand operated unit, is available. The rectangular drip-proof cabinet has removable sides and top cover that permit access to all parts. A number of welders can be paralleled to produce greater output. Panel mounted voltmeter and ammeter can be supplied.

Manufacturer—Miller Electric Mfg. Co., Inc., 718 S. Bounds St., Appleton, Wis.

THESE TYPICAL INSTALLATIONS ATTEST TO THE WIDE ACCEPTANCE OF

GENERAL BLOWER PRODUCTS



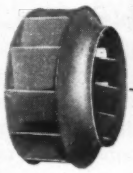
Hospitals

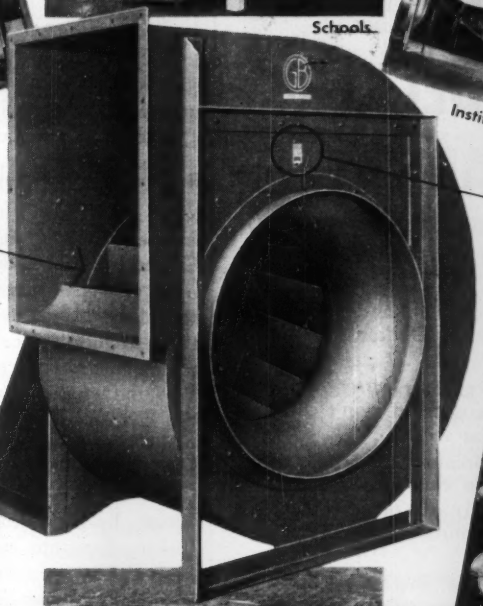
Schools

Institutions

GENERAL TYPE BB CENTRIFUGAL FAN

NEW DESIGN RESULTS IN HIGH EFFICIENCY AND QUIET OPERATION





CERTIFIED RATINGS

Certified ratings are the result of tests made by the Manufacturer in accordance with the Stand ard Test Code for Centrifugal, Axial, and Propeller Fans adopted jointly by the National Association of Fan Manufacturers and the American Society of Heating and Ventilating Engineers.

AUTHORIZED BY N A F M

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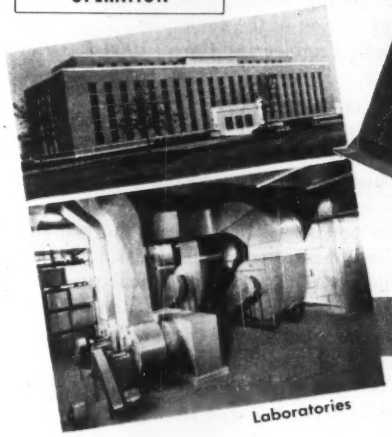
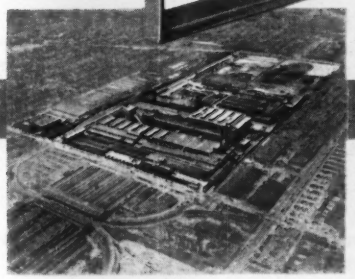
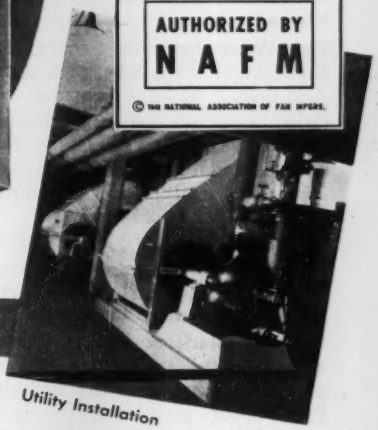


Laboratories



Industry



Utility Installation

WRITE FOR BULLETIN BB102

MANUFACTURERS OF **BLOWERS · FANS · EXHAUSTERS**

GENERAL BLOWER COMPANY

SINCE 1933

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ENGINEERING AND SALES OFFICES IN PRINCIPAL CITIES

BLACK & DECKER PORTO-SHEARS* Cuts Job-Time 75%

HERE'S a real time-, trouble-, and labor-saver . . . the Black & Decker Porto-Shears.

This Porto-Shears *cuts many times faster than hand snips.* Cuts where snips often won't cut. And does it without muscular strain.

Gives excellent results. Because the cutting action is always visible, you can follow lines and irregular patterns easily. You can cut curves to small radii. Eliminates burrs and ragged edges.

Cuts many materials. Powerful shearing action makes it possible to cut various steels, Monel, copper, aluminum, lead, etc. Also thin sheets of plastics or wood laminates.

Like all Black & Decker Tools, Porto-Shears are made to last. Husky housings, precision parts, B&D-built motors for plenty of power. Porto-Shears give long, trouble-free service . . . service that saves time, cuts costs on every job. Call your B&D Distributor (listed in telephone book "Yellow Pages") for demonstration. Write for new 1954 catalog with descriptions of over 100 B&D Portable Electric Tools. Address: The Black & Decker Mfg. Co., 640 Pennsylvania Ave., Towson 4, Md.

*Trade Mark Registered U. S. Pat. Off.

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B&D Black & Decker PORTABLE ELECTRIC TOOLS

RECENT TRADE LITERATURE..

Air Filters

Bulletin 500 illustrates and describes the "Staynew" automatic filters designed for large air volume. The bulletin contains specifications, engineering and performance data and photographs of the various types.

Manufacturer—Dollinger Corp., 11 Centre Park, Rochester 3, N.Y.

Air-Powered Pumps

Bulletin No. 1053 on air-powered controlled volume pumps shows how these pumps are used to solve low-capacity flow control problems. It contains a graphic presentation of pump operating principles and capacity-pressure and air-consumption tables.

Manufacturer—Milton Roy Co., 1300 East Mermaid Lane, Station J, Philadelphia 18.

Air Sampler

Specification sheet describes the design features of an air sampler for use in air and stack sampling in industrial hygiene and air pollution investigations. The sampler, weighing under 10 lb, combines all apparatus used for field sampling of gases, vapors and dusts.

Manufacturer—Compact Air Samplers, Demarest, N.J.

Boiler Water Sample Cooler

Bulletin No. 110 describes the company's heat exchanger unit, the "Paracoil" Boiler Water Sample Cooler No. 75." In addition to the design specifications, a set of charts is included to determine cooling water flow rate for various sample temperatures. Additional features include typical piping hookups and instructions on the installation and operation of the cooler.

Manufacturer—Davis Engineering Corp., 1064 E. Grand St., Elizabeth 4, N.J.

Cast High Alloys

A reprint of an article, *Cast High Alloys*, by E. A. Schoefer, executive vice president, Alloy Casting Institute, now is being offered. The article discusses the cast corrosion resistant alloys most generally used for process equipment in the chemical industries. Tables indicating the physical and mechanical properties of cast corrosion resistant alloys, and the standard designations and chemical composition ranges for heat and corrosion resistant castings are included.

Reprinted by—The Cooper Alloy Foundry Co., Bloy St. and Ramsey Ave., Hillside, N.J.

Cellular Glass Installation

The use of "Foamglas" in industrial and commercial buildings is covered in a new 24-page catalog. The publication lists condensed specifications for the application of the material in walls, ceilings, floors, roofs, perimeters and in low temperature space insulation. Complete information on all accessory materials is also listed. Physical properties, characteristics and performance data are included. Several photographs show actual installations.

Manufacturer—Pittsburgh Corning Corp., One Gateway Center, Pittsburgh 22, Pa.

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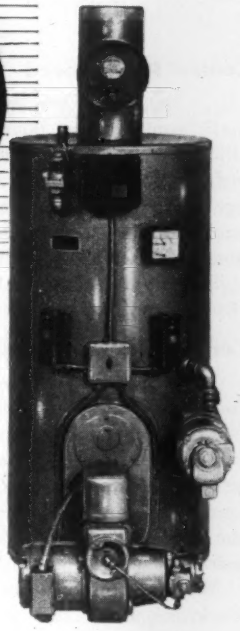
..when Selling gets **HARDER!**



ALDRICH Gulf Stream PACKAGE BOILER-BURNERS

Home building is leveling off – and competition for heating plant installations is keener. Now you will have a better chance of getting your share if you feature the new Aldrich GULF STREAM Boiler-Burner. Here's why:

The GULF STREAM was developed for small home owners to furnish economical hot water heat and instant domestic hot water supply with either oil or gas. Five sizes cover every need and budget. SBI net ratings from 440 to 1120 sq. ft. of water radiation. All meet ASME code.

COMPACT and RUGGEDLY BUILT GULF STREAM is easy to install, efficient and dependable. The Aldrich GULF STREAM will close more sales when people demand MORE for every heating dollar invested. Write for money-making details.

GULF STREAM STANDARD

Shipped fully erected with complete automatic controls; stack switch, thermostat and limit control.

HOT WATER HEATER

Internally galvanized in five sizes with 93-255 GPH at 100° rise. Instant, directly heated, hot water supply.

ALDRICH GULF STREAM Offers VALUE!

SBI ratings, 440-1120 sq. ft. water radiation.
Flue tubes baffled for maximum heat extraction
Aldrich burners operate Gulf Stream boilers
For inspection and maintenance, removable top jacket, large opening to combustion chamber.
Min. temperature change regardless of firing conditions.
Designed for standardized production; to meet ASME code.
Burners U.L. listed

A subsidiary of Breeze Corporations, Inc.

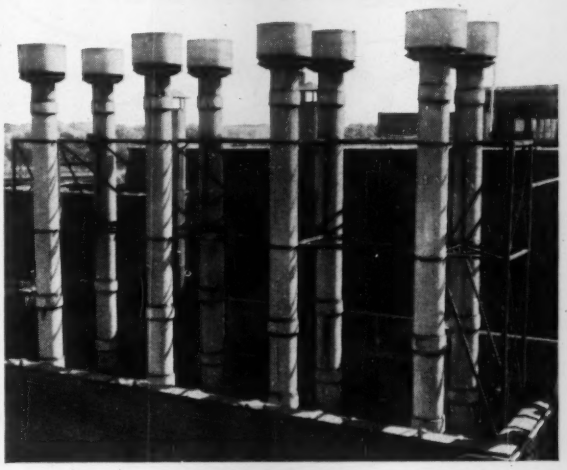
ANOTHER BREEZE MARK PRODUCT

ALDRICH
105 Williams St.
WYOMING, ILLINOIS

SBI ALDRICH HEAT-PAK PRODUCTS

Year after Year

In industry after industry...



TRANSITE® INDUSTRIAL VENT PIPE

defies corrosive fumes, vapors

IN INDUSTRY AFTER INDUSTRY where venting was a difficult problem, Transite Industrial Vent Pipe has demonstrated its ability to stand up under severe conditions. Instances are common of original Transite installations, *still* serving without replacement cost, after periods of over 20 years.

Made of asbestos and cement, Transite Industrial Vent Pipe is highly resistant to corrosive fumes, vapors, dusts and gases. And, of course, it is weather-resistant, too. Non-metallic, it needs no painting or other protective treatment.

Light in weight, easily cut and drilled with ordinary tools, Transite Industrial Vent Pipe is readily handled and erected. It is available in a wide range of diameters, offers a line of Transite fittings that make it outstanding for many kinds of venting jobs.

For further information write to Johns-Manville, Box 60, New York 16, N.Y.

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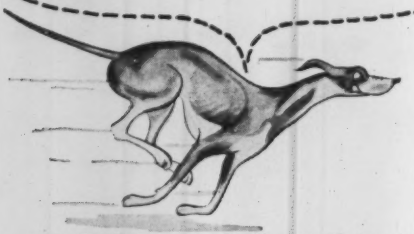
Johns-Manville
TRANSITE INDUSTRIAL VENT PIPE

Here's why AGITAIR FM AIR FILTERS are so doggone popular!



High velocity...highest efficiency.

⅓ less space required.

Lower installation and maintenance costs.

Long serviceable life.

Designed for an approach velocity of 530 fpm over the net media area, the high filtering efficiency of the AGITAIR FM increases as the dust load is applied. You save ⅓ in space required, in number of units to be installed and serviced. Very large dust-holding capacity of AGITAIR FM assures longer service periods, fewer cleanings per year, lower service charges. No exposed wire ends to cut or damage hands of service operators. Compare. Send today for free Cost Comparison Chart.

AIR DEVICES INC.
185 Madison Avenue, New York 16, N. Y.

FILTERS • AIR DIFFUSERS • EXHAUSTERS

RECENT TRADE LITERATURE . . .

[Continued]

Control Panel Board

New bulletin describes a 10-service automatic control panel board "package" for the process and allied industries. Included in the arrangement are standard, semi-graphic and graphic control boards. The "package" consists of instrumentation planning by the company's engineers, purchase of instruments, design of the board, fabrication and all field installation.

This service is offered by the J. P. O'Donnell Corp., Instrument Div., 39 Broadway, New York 6.

Controls for Hot Water Heating

Bulletin F 6167 contains complete information on the manufacturer's electronic controls for hot water heating systems. According to the manufacturer, by turning a knob the ratio of change in outdoor temperature to change in water temperature can be adjusted. The catalog also contains information concerning the use of an optional night depression with a morning warm-up feature.

Manufacturer—Barber-Colman Co., 1228 Rock St., Rockford, Ill.

Corrosion Resistance of Stainless Steels

Bulletin TDC 160 contains information on the comparative corrosion resistance of stainless steels to corrosive media. It presents data on six widely used stainless tubing steels and several hundred corrosive media at various temperatures and concentrations. The folder is designed to assist engineers involved in the selection of stainless tubing and pipe for corrosion resistance applications.

Manufacturer—Tubular Products Div., The Babcock & Wilcox Co., Beaver Falls, Pa.

Deaerating Heater

Publication No. 4643 describes the "Uni-Pac" deaerating heater designed for small and medium size power plants. The deaerator is self-contained and factory assembled for field installation on a variety of storage tank sizes. Operation, design, capacities and advantages are fully described.

Manufacturer—Cochrane Corp., 3131 N. 17th St., Philadelphia 32.

Diaphragm Motor Valves

Twelve-page bulletin No. 362 describes the company's "Series 362" line of diaphragm motor valves for on-off or narrow band proportional control. Complete specifications are given for single seated and bellows sealed valves.

Manufacturer—Minneapolis-Honeywell Regulator Co., Industrial Div., Wayne and Windrim Aves., Station 64, Philadelphia 44.

Driver for Steel Studs

Bulletin No. 1401-2 illustrates and describes the design and operation of the "Model P" driver, a portable powder-actuated tool for driving steel studs into steel, concrete or masonry. Blank cartridges are used

RECENT TRADE LITERATURE . . .

[Continued]

to drive the steel studs. Cartridge heads are painted in key colors to identify loads.

Manufacturer—Velocity-Power Tool Co., 210 N. Braddock Ave., Pittsburgh 8, Pa.

Dust Collection

The general problem of dust collection in the food and processing industries and "Aerodyne" dust collectors are discussed in Bulletin 171. The theory and design of these collectors are described in detail. Drawings show various types of collector systems.

Manufacturer—The Green Fuel Economizer Co., Inc., 918 Main St., Beacon, N.Y.

Electric Heaters Catalog

The 1954 edition of the manufacturer's catalog GEC-1005E, on "Calrod" electric heaters and heating devices now is available. Units are described in terms of application, special features, installation and pricing. More than 175 photographs illustrate products such as immersion, strip, cartridge, tubular, insertion and fin heaters, melting pots, thermostats, switches and oven heaters. The catalog also contains methods for determining power requirements and heat losses for many applications.

Manufacturer—General Electric Co., 1 River Rd., Schenectady 5, N.Y.

Electric Heating Applications

Principal industrial electric heating applications and methods are described in the booklet, *101 Ways to Apply Electric Heat.* Illustrated case histories show the industrial uses of metal-sheathed electric heating units. Physical aspects of installation are shown. Liquid heating is shown in addition to a description of the problems of heating air and gases, heating machinery and equipment parts and melting soft metals and viscous materials. One section is devoted to far-infrared heating.

Manufacturer—Edwin L. Wiegand Co., 7610 Thomas Blvd., Pittsburgh 8, Pa.

Expansion Compensator for Piping

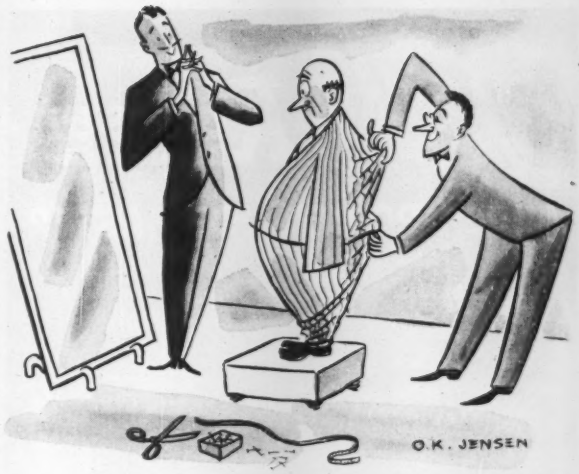
Two-color bulletin, No. 138, describes an expansion compensator for controlling pipe expansion in low pressure hot water or steam heating systems. It is designed for finned-type convectors, baseboard, radiator or heating supply and return lines.

Manufacturer—Flexonics Corp., 1391 S. Third Ave., Maywood, Ill.

Fan Engineering Data

Bulletin A-108, *Fan Engineering Data,* includes fan laws and formulas, terms and definitions, recommended velocities for exhaust hoods, an air pressure conversion table, and charts covering duct resistance, entrance losses and rectangular equivalents of round ducts. Other sections discuss fan installation, maintenance and lubrication, explanations of noise problems, and characteristics of various propeller and wheel designs.

Manufacturer—Hartzell Propeller Fan Co., P.O. Box 909, Roosevelt Ave., Piqua, Ohio.



No need to improvise or compromise when you specify

AGITAIR

Only AGITAIR square and rectangular air diffusers are custom-made to suit conditions of each application. The patented, built-in diffusing vanes are scientifically arranged in various louver patterns which provide blows in 1, 2, 3 or 4 directions without use of blank-offs. This feature eliminates the necessity of "oversizing" to compensate for blank-offs or baffles.

When you specify AGITAIR square and rectangular diffusers you can be sure of 100% draftless air distribution from any ceiling or sidewall location. What's more, these smart, modern units are now available with or without removable, interchangeable cores. Whatever the space condition, there's an AGITAIR custom-made to give perfect performance and complete satisfaction.

New 34-page Type R Catalog reveals how correct air distribution is simplified by AGITAIR. Contact your local AGITAIR representative, or write us direct for your free copy.

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AIR DIFFUSERS • FILTERS • EXHAUSTERS

NEW FEATURES for
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Shortest, lightest heavy-duty tool

Greatest driving power

New series of power-sealed charges balanced to the tool

Circle-Set Shield, adjustable for 12 positions of handle

Faster, easier operation

All the family characteristics of RAMSET JOBMASTER and PLUS-POWER JOBMASTER are built into the new SUPER-POWER JOBMASTER for heavy-duty fastening into steel up to 1" thick or the hardest concrete. Ask your dealer to demonstrate the many new features which make SUPER-POWER JOBMASTER the outstanding powder-actuated tool for speed, ease, utility and economy, and show you how it takes over where all others leave off. Or, write us for details.

Ramset Fasteners Inc.
Ramset Division, Olin Industries, Inc.
12109 BEREA RD. • CLEVELAND 11, OHIO

FIRST IN POWDER ACTUATED FASTENING AN Olin PRODUCT

RECENT TRADE LITERATURE . . .

[*Continued*]

Glass Blocks for Industrial Use

New 24-page catalog, *P.C. Glass Blocks for Industrial, Commercial and Public Buildings,* is designed as a reference manual for architects, engineers and contractors. Included is information on physical performance, technical data on light transmission, insulation values, installation detail drawings, accessory materials and complete specifications.

Manufacturer—Pittsburgh Corning Corp., One Gateway Center, Pittsburgh 22, Pa.

Hard Rubber Pumps and Fittings

"Buna N" and natural hard rubber pumps, valves and pipe fittings for the chemical process and allied industries are covered in this four-page bulletin. Physical properties and chemical resistance data are contained, with illustrations, performance data tables and specification charts for the products.

Manufacturer—Vanton Pump & Equipment Corp., Empire State Bldg., New York 1.

Hood for Polishing Wheels, Belts

Pamphlet describes a self-filtering hood designed for buffing and polishing wheels and belts. Known as the "Elim-O-Dust," the hood utilizes a principle whereby dust is withdrawn and controlled by the wind created by the revolving wheel or belt. The literature contains detailed design, operating and application features of the product. Engineering drawings show the component parts.

Manufacturer—Slonneger Products Co., 1524 Milburn Ave., Dayton 4, Ohio.

Instrument Transformer Guide

Illustrated 96-page publication, GEA-4626G, is the 1954 edition of the company's *Instrument Transformer Buyer's Guide.* It contains ratings, ASA accuracy classifications and prices of the company's indoor and outdoor potential and current transformers. Listings of ratio and phase-angle tests, together with tables covering the mechanical and thermal limits of current transformers are included.

Manufacturer—General Electric Co., 1 River Rd., Schenectady 5, N.Y.

Insulation Guide for Underground Pipe

Tips on the installation of "Gilsulate," insulation for hot underground pipe, is given in this illustrated booklet. A series of photographs shows each step of installation.

Manufacturer—American Gilsonite Co., 134 W. Broadway, Salt Lake City 1, Utah.

Ion Exchange

Ion exchange technology and industrial uses are explained in the bulletin, *Amberlite Ion Exchange.* Fundamental ion exchange processes are described with the aid of a full page of two-color drawings. In the introductory section is a brief history of synthetic resin ion exchange development as well as explanatory material on

RECENT TRADE LITERATURE . . .

[*Continued*]

regeneration and deionization. In the application section, the field is broken down into 13 process types.

Manufacturer—Rohm & Haas Co., Resinous Products Div., Washington Sq., Philadelphia 5.

Liquid Level and Air Flow Detector

Application and installation information is given in a new booklet on the "Detect-A-Flo," a device designed to control and detect both liquid level and air flow. Also included is the principle of operation of the unit which has no moving parts, is hermetically sealed and is installed directly in the tank or air stream being monitored. Detailed specifications, including response curves, on the performance, operation and electrical characteristics of the unit under various conditions of use are given.

Manufacturer—Fenwal Inc., 130 Pleasant St., Ashland, Mass.

Measuring Instruments

Condensed bulletin presents the company's line of specialized instruments and gages. Included are instruments for measurement of combustion, draft, pressure, flow, vacuum, CO_2, smoke, velocity, static pressure, pressure differential, temperature and other similar studies. Each type is illustrated and described.

Manufacturer—F. W. Dwyer Mfg. Co., 317 S. Western Ave., Chicago 12.

School Heating Problems

Classroom heating problems and solutions are described in a new handbook for school maintenance personnel. The booklet, *General Maintenance of Pneumatic Control Systems*, is designed to acquaint school custodians with the complex system of heating and heat-regulation used in the modern school and to provide reference material when trouble develops.

Manufacturer—Minneapolis-Honeywell Regulator Co., 2641 4th Ave., S., Minneapolis 8, Minn.

Speed Reducers for Cooling Towers

Catalog CT-53 offers information on the use of gear reduction drives in cooling tower applications. Full construction and operation details, illustrations and selection data are given for the three types of speed reducers—a worm gear unit, a spiral-bevel unit, and a helical-spiral-bevel unit.

Manufacturer—Philadelphia Gear Works, Erie Ave. and G St., Philadelphia 34.

Stainless Steel Tubing

Bulletin S-222 describes the advantages and applications of seamless and welded stainless steel tubing. A workability chart shows available types and sizes, resistance characteristics, electrical, thermal and physical properties and relative workability. Other tables give dimensions and typical analyses of various types. A section on technical and fabricating data includes tables of standard tolerances.

Manufacturer—Globe Steel Tubes Co., 3839 W. Burnham St., Milwaukee 46, Wis.

Announcing **DRAVO'S COMPLETE LINE OF HEATERS**

ALL DRAVO HEATERS have automatic temperature control and a minimum efficiency of 80%... require no ductwork ... are ideal for heating in the winter, ventilation in the summer and for process drying.

DRAVO CORPORATION

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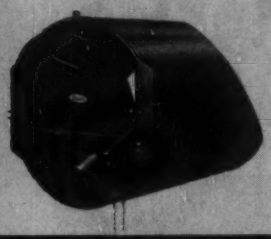
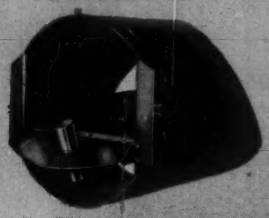


DOWN-DRAFT VIEW

Gate opens outward to relieve down drafts which might affect flame. An optional safety switch closes main gas valve in case of prolonged down draft, thus providing full protection.



UP-DRAFT VIEW

Gate opens inward to regulate updrafts in conventional, proven manner, checking any excess in draft.

field

"MG" Draft Controls

ENGINEERED SPECIFICALLY FOR

GAS

fired industrial and commercial plants

1. Double acting gate opens inward to regulate up-drafts and outward to relieve down-drafts.
2. Adding or taking off weights provides simple adjustment for up-draft conditions at time of installation.
3. Control will relieve internal or down-draft pressures of only a few thousandths of an inch.
4. Weights attached to gate itself are factory set to insure extreme sensitivity to down-draft conditions.
5. Corrosion resistant knife edge bearings resting on self-aligning bearing plates assure extreme sensitivity yet long life.
6. Side wings improve the regulation, making the control accurate at all gate positions.
7. Long collar keeps gate out of the path of flue gases — resulting in greatly increased life.

The Field "MG" has met the most rigid municipal requirements for commercial and industrial installations. It is being used with full approval of the nation's leading gas companies in the nation's largest cities. Fully safe, fully proven, it provides for gas-fired installations the same accurate, dependable performance, the fuel economy so long provided by Field Draft Controls for oil and coal fired furnaces. Write for complete information.

FIELD CONTROL DIVISION

of H. D. Conkey & Company — Mendota, Illinois

AFFILIATES: Conco Building Products, Inc. — Brick, Tile, Stone
Conco Materials Handling Division — Cranes, Hoists

RECENT TRADE LITERATURE . . .

[*Continued*]

Stranded Electrodes

Stranded Electrode Materials for Aircomatic Welding is the title of a reprint from the *Welding Journal*. The article discusses the use of stranded wires in the inert-gas-shielded metal-arc welding process. Some of the points covered include construction of stranded electrodes, welding characteristics and case history applications.

Reprinted by—Air Reduction Sales Co., 60 E. 42nd St., New York 17.

Temperature and Pressure Relief Valves

Your Handbook on Temperature and Pressure Relief Valves explains and illustrates the function of relief valves, both temperature and pressure, in relation to industrial and domestic water heaters. Included are AGA and ASME code requirements and recommended code requirements for cities and inspectors. The pamphlet also lists 25 "do's and don'ts" for relief valve users.

Manufacturer—A. W. Cash Valve Mfg. Corp., Wabash and Morgan, Decatur 60, Ill.

Transmission Belting

Catalog on rubber transmission belting describes and illustrates the construction features of various industrial belts and gives recommended usages. A special section is devoted to oilproof, textile, lumbermill and agricultural belts. The method of making the "Plylock" belt joint is described with accompanying illustrations.

Manufacturer—The B.F. Goodrich Co., 548 S. Main St., Akron 18, Ohio.

Vaporsealing Insulation

Complete recommendations for vaporsealing insulation on low temperature vessels are given in this new 80-page book. Titled *Vapor and Weather Barriers for Low Temperature Installations*, it contains 54 illustrations showing where and how a vaporseal coating should be applied over thermal insulation. The coating is used to prevent deterioration of the insulation and rusting of the vessel beneath it due to moisture and moisture vapor. Three major classes of insulation are covered.

Published by—The Insul-Mastic Corp. of America, 1141 Oliver Bldg., Pittsburgh 22, Pa.

Wobble-Rod Air Valve

Bulletin No. 61861 describes the new wobble-rod air valve for on-off control with pneumatic systems. In addition to giving specifications, the bulletin illustrates application ideas covering a variety of actuating mechanisms, hook-ups and multiple-valve arrangements. Included are photographs both of the valve and its use in cam-actuated mechanisms, sectional drawings of the internal check valve, exhaust valve and other features. Engineering drawings show dimensions and part details.

Manufacturer—Pantex Mfg. Corp., P.O. Box 660, Pawtucket, R.I.

WE HEAR THAT . . .

Ground was broken recently for a $500,000 plant expansion at the Anaheim Div. of the *ROBERTSHAW-FULTON CONTROLS CO.*, in suburban Los Angeles. A new wing will house two research and development laboratories, an auditorium, offices and a cafeteria.

The *UNITED STATES AIR CONDITIONING CORP.* has leased a group of industrial and office buildings on a 25-acre tract adjoining its existing main plant and offices in Minneapolis, which will double its manufacturing space. This is the initial step in a long-range program planned by the company's new management. The new factory buildings will be utilized for the manufacture of coils, blowers and room air conditioners.

An air conditioning school for the entire field personnel of *UNITED STATES RADIATOR CORP.* has been announced. According to *J. ROY KNOX*, vice president-sales, the seven-week school will emphasize the technical side of year 'round air conditioning. All phases of design, calculation and specification of summer cooling, in combination with winter heating, will be covered in the course. Head of the school will be *LORIN C. MILLER*, dean emeritus of the College of Engineering, Michigan State College.

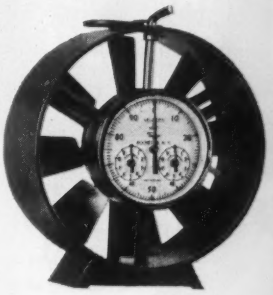
Ten new Southern Pacific chair cars have been equipped with electronic temperature controls and hot water radiation floor heating, according to an announcement by *MINNEAPOLIS-HONEYWELL REGULATOR CO.* This installation uses a single-valve electronic control to reduce the chance of system failure. Each car will use three electronic thermostats to regulate heat and air conditioning according to the outside air, indoor temperature and the heat of the discharge air.

"Century" asbestos-cement pressure pipe now is being produced at Santa Clara, Calif. in the newest plant of *KEASBEY & MATTISON CO.* Recently completed at a cost of $2,750,000, the new plant occupies a 26-acre site. Total area of the plant is 182,300 sq ft.

The *ALADDIN HEATING CORP.* has begun construction on a new plant at 1111 West Avenue 137, San Leandro, Calif. The new facilities will consist of a two-story office building centrally located among production and storage structures. Current construction will be restricted to four main buildings that will total 82,000 sq ft of under-roof floor space, plus one and one-quarter acres of concrete slab on which future units will be built.

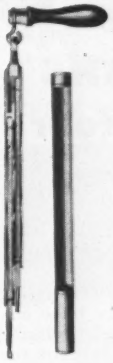
A new division, the Amstan Supply Div., has been created by the *AMERICAN RADIATOR & STANDARD SANITARY CORP.* The new organization takes over all operations of the corporation's former branch house department. Headquarters of the new division are in Pittsburgh with branches located in 22 states in the midwest,

HOW FAST?



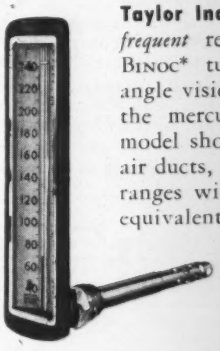
Taylor Biram's Anemometer is designed for use in air ducts, tunnels, furnaces, flues, etc. The three dials register velocity of air currents to 10,000 ft. Each instrument is tested and a chart of corrections furnished for velocities of from 200 to 3,000 ft. per minute. **Catalog #3132. Price $75.00.**

HOW MOIST?



Taylor Sling Psychrometer is considered the basic standard for accurate measurement of relative humidity, since it provides a simple means for creating suitable circulation of air. Length 12". Catalog No. 1321: 30° to 200° in 1° divisions—**$9.00.** Catalog No. 1322: 20° to 120° in ½° divisions—**$9.00.** Catalog No. 1324; 25° to 40° in 1/10° divisions—**$13.00.**

HOW COLD?

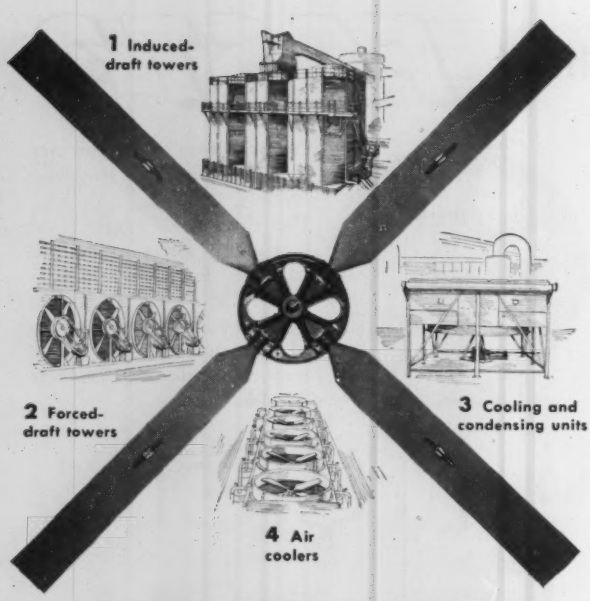


Taylor Industrial Thermometers invite *frequent* reading, thanks to exclusive BINOC* tubing which provides wide angle vision and high magnification of the mercury column. The 90° angle model shown is especially suitable for air ducts, dry kilns etc. Many standard ranges within minus 50 to +400°F or equivalent Centigrade. Your choice of stem angles and connections. Thermometer illustrated (Range 0° to 160°F, 6" stem, 9" scale). **Catalog #12EU349. Price $25.25.** *Reg. U. S. Pat. Off.

There is a Taylor Instrument or control system for every air conditioning need. Ask your Taylor Field Engineer or write Taylor Instrument Companies, Rochester, N. Y., and Toronto, Canada. *Instruments for indicating, recording and controlling temperature, pressure, flow, liquid level, speed, density, load and humidity.*

Taylor Instruments

MEAN ACCURACY FIRST



AEROMASTER FANS
First choice for all four

Ask the manufacturer . . . *ask the user* . . . what fan he prefers for his cooling equipment. Chances are he'll say Aeromaster.

Why? Because he knows from experience that Aeromaster Fans can be relied upon to give good service.

Aeromaster Fans are *precision-engineered,* adapted from high speed aircraft propellers. They have adjustable blade pitch and anti-flutter design . . . therefore, require less horsepower. And they last longer too, thanks to the exclusive Aeroloid blade coating to resist acids and alkalies, abrasion and weather. Overall result: Aeromaster Fans *give more cooling at lower cost.*

Available in 4, 6, or 8 blade styles, in diameters of 5 to 24 ft., with capacities up to 1,000,000 cubic feet per minute, all Aeromaster Fans are fully guaranteed.

Koppers also has trained engineering specialists available in principal cities, insuring prompt, expert Aeromaster Fan service. And Koppers is always ready to consult with you on special fan problems. Next time you plan a replacement of present fans, specify Aeromaster. And when you consider new equipment, call on Koppers . . . always eager to be of service.

KOPPERS ®

Aeromaster Fans

METAL PRODUCTS DIVISION • KOPPERS COMPANY, INC. BALTIMORE, MD. This Koppers Division also supplies industry with Fast's Couplings, American Hammered Industrial Piston and Sealing Rings, Koppers Electrostatic Precipitators and Gas Apparatus.

Engineered Products Sold with *Service*

MAIL COUPON TODAY FOR COMPLETE INFORMATION

KOPPERS COMPANY, INC., *Aeromaster Fans*
242 Scott St., Baltimore 3, Md.

Gentlemen: Please send me detailed information on Aeromaster Fans for .....(name and type of equipment to be cooled).

Name.....

Title.....Company.....

Address.....

City.....Zone.....State.....

WE HEAR THAT . . .

[*Continued*]

southwest and Pacific coast areas. The branch offices will supply materials required for heating, air conditioning and plumbing installations. Top executives of the new division are *ROBERT F. SELLS*, president and *JOSEPH SALAMONE*, executive vice president.

NATIONAL CYLINDER GAS CO. has simplified its corporate structure. Two of four wholly-owned subsidiaries now operate as divisions and the corporate charters of the remaining two have been surrendered and their operations taken over by the parent company. Tube Turns, Inc., with headquarters in Louisville, has become the Tube Turns Div. Pennsylvania Forge Corp. of Philadelphia has become a division known as Pennsylvania Forge Co. The Hollup Corp. of Chicago, and National Cylinder Gas Co.—Pacific Coast, have been dissolved. All officers of the two former corporations have been re-elected to the same offices in the new companies.

Two York Corp. engineers, *NEIL E. HOPKINS*, senior engineer, and *J. J. SEELAUS*, district engineer, have received the Wolverine Award of the *AMERICAN SOCIETY OF REFRIGERATING ENGINEERS* for the best paper published in the Society's journal in 1953. Their paper, *Temperature Change as Affected by Different Pulldown Methods*, appeared in the January 1953 issue.

Sale of the manufacturing assets of the *EUREKA WILLIAMS CORP.* to the *HENNEY MOTOR CO.* of Freeport, Ill. was approved at a recent meeting of the Eureka Williams stockholders. The Freeport firm manufactures specialized automotive bodies. The use of the proceeds of the sale of the Eureka Williams Corp. has not yet been determined.

MARTIN MACK, president of *READING TUBE CORP.*, has announced the removal of the company's sales and executive offices from Long Island City, N. Y. to the Empire State Building in New York City. Removal of Reading's eastern distribution depot from Long Island City to 57-15 Northern Blvd., Woodside, N. Y., has also been announced. Scheduled to open in the near future is a new depot in Cleveland.

DALY, MERRITT & SULLIVAN, manufacturer of "Desomatic" dehumidifiers, has announced the completion of a new addition to the plant at Falls Church, Va.

SAWHILL TUBULAR PRODUCTS, INC., a Pennsylvania corporation, now is the surviving corporate entity of a merger of *MERCER TUBE and MFG. CO.* and *SHENANGO AGALOY TUBE CO.*, both Delaware corporations, into the *SAWHILL MFG. CO.* The merger will coordinate management and ownership and integrate the interstate operating facilities. The Mercer name will be maintained and will operate as the Mercer Pipe Div. within the new corporate structure. President of the new company is *D. V. SAWHILL.*

You'll save up to 50 per cent with the new SILENT DUCT

TRADE MARK

Pre-assembled metal and material pulls out flat and ready to use

LET'S PUT IT THIS WAY...you need some flexible duct connections. As the first step, you attach canvas or asbestos to strips of metal... a job that takes time and costs money. In shop after shop 50% to 60% is being *saved* today by using *Elgen Silent Duct*, the new connection material that comes to you pre-assembled for immediate fabrication.

Elgen Silent Duct is delivered in 100-foot (approx.) coils in a handy dispenser... *pulls out absolutely flat* and ready to use. It is made of 24-gauge galvanized steel, fastened to your choice of fire, water and mildew-resistant canvas (Govt. Spec. MIL-D-10860) or to heavy, top quality asbestos.

Order *Elgen Silent Duct* from your jobber and make savings that really help you get business. If necessary, ask us for your nearest source of supply. And write us for new free folder that tells the whole *Silent Duct* story. **Elgen Manufacturing Corporation, Dept. B-2, 41-34 39th St., Long Island City 4, New York.**

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SILENT DUCT

SAVES ASSEMBLING CONNECTION MATERIALS

ONLY *ELECTROMODE* **ALL ELECTRIC HEATERS have all 3**

Triple Assurance With . . .

HEAT

Where You Need It!

- HARD-TO-HEAT AREAS
- REMOTE LOCATIONS
- PROBLEM INSTALLATIONS

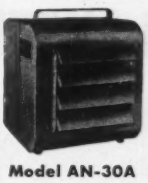
- ***Quick, easy to install***
- ***Minimum maintenance***
- ***100% efficient***
- ***Automatic control***
- ***Clean, fan-circulated heat***
- ***User Satisfaction***

SUSPENSION TYPE MODELS

10,000 to 45,000 watts. For complete or auxiliary heat in large areas. Adjustable louvers for directing heat where desired.

Model 14-10

COMBINATION PORTABLE



and Suspension Type Models. 1500 to 7500 watts. Plug in temporarily or mount on swivel brackets. Adjustable louvers.

Model AN-30A

FOR HOMES - OFFICES - MOTELS STORES ETC.

Electromode Wall-Type Heater has built-in thermostat for individual room temperature control. Fan-circulated heat is distributed by down-flo principle. 1500 to 4000 watt capacities.

Model WA

100% SAFE

Hot resistor wires are insulated and embedded within a finned aluminum casting, assuring positive protection from fire, shock or burn. This finned type element acts as a superior heat diffuser, resulting in greater heating economy.

5 YEAR GUARANTEE

The patented, cast-aluminum heating element is guaranteed for five years against all defects of material or workmanship.

The Famous GE UNIT MOTOR

Totally enclosed construction protects motor from entry of dust. Large supply of oil sufficient for years of motor operation is factory-sealed-in. Forced lubrication system assures long life and quiet operation.

SAFETY SWITCH

Built into every Electromode Heater is a small thermal safety switch, located on or near the heating element. If for any reason the air flow should stop, causing overheating of the element, this safety switch automatically shuts off the current.

Approved by Underwriters' Laboratories

ELECTROMODE CORPORATION

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Please send free literature on:

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WHO'S WHAT . . .

WILLIAM J. STEWART has been appointed general manager of the *KAYLO DIV., OWENS-ILLINOIS GLASS CO.* Mr. Stewart has been with the company for 23 years, during which time he was with the engineering departments of several divisions. In 1949 he was appointed chief industrial engineer in the administrative division. He will retain this position along with his new one.

MUNDET CORK CORP. announces several personnel changes. *D. W. McKEE* is sales manager in charge of low temperature products, and *J. M. HIGH* is sales manager for the heat insulation and high temperature products of the company. *E. LUCHS* heads the insulation division and is also vice president of the company. *W. HARVEY MATTSON* has been appointed sales manager of the company's industrial division.

E. R. GLAUBER has been appointed national sales manager for air conditioning by *EMERSON RADIO and PHONOGRAPH CORP.* Mr. Glauber will continue to act as a director of the company in addition to assuming his new duties. Mr. Glauber has been with the company since October. He was formerly with Admiral Corp.

EMERSON ELECTRIC MFG. CO. has announced the election of *WALLACE R. PERSONS* as president and a director of the company. Mr. Persons was formerly with the Lincoln Electric Co. as general sales manager. He will succeed *W. S. SNEAD*, who was both president and chairman of the board of directors and will remain as board chairman.

DOUGLAS C. ALBRIGHT has been appointed works manager of *COLEMAN CO., INC.* of Wichita, Kans. He will direct and coordinate all phases of industrial engineering, production engineering, manufacturing and quality control for the company. Mr. Albright was formerly general manager of the Marysville Div. of Ainsworth Mfg. Corp.

ALLEGHENY LUDLUM STEEL CORP. has announced the appointment of *LOUIS B. POLEN* as plant manager of the company's Buffalo foundry. Mr. Polen succeeds R. J. Bryan, who plans to retire.

The firm also announces that *WILLIAM J. BALDWIN* has been appointed west coast technical representative. He was formerly assistant plant manager at the company's New York plant. Mr. Baldwin's successor will be *RICHARD P. STEMMLER*, who was manager of the company's Los Angeles forge. Replacing Mr. Stemmler is *DONALD J. ROBERTSON*, also of the Los Angeles plant.

CLYDE E. ROBERTS has been appointed manager of sales of *REPUBLIC STEEL CORP.* in the alloy steel division. He will succeed *MARTIN H. SCHMID*, who is retiring after 44 years of service with Republic and predecessor companies. Mr. Roberts was formerly assistant

Where the problem is ventilation — the solution is a **WESTERN SYSTEM**

AT NORTHROP AIRCRAFT INC.

Problem: The Anaheim, Calif. Division of Northrop Aircraft, Inc. manufactures optical range finders and other ground weapon fire control devices for U.S. Army Ordnance. Dust-free ventilation a must! Solution: 38-30" Western Rotaries with Western-aire Curb-Mounted fans exhaust 18 million cubic feet of air per hour from the 250,000 sq. ft. building.

AT YOUR PLANT

Western Rotary ventilators, with or without fans, can do the most for you. A 2 mph wind operates the Western Rotary—and it continues to exhaust during wind lulls due to superior balance design. Years of trouble-free performance—bearings carry lifetime guarantee. Check Sweet's or AEC for high exhaust capacity figures. Then specify Western—a first-rate line of rotary, stationary, continuous ridge, directional ventilators and exhaust fans. Handled by wholesalers coast to coast.

Western Engineering & Mfg. Co.

4118 OCEAN PARK AVE. • VENICE • CALIF.

Dealers—order from your local jobber.
Write for catalog, or tell us your special installation problems.

WHO'S WHAT . . .

[*Continued*]

manager and has been connected with the steel industry since 1920.

The *TORRINGTON MFG. CO.* has appointed *GUSTAVE H. FROELICH* general manager of the company's Machine Div. Mr. Froelich has been with the company since 1943 and was elected a vice president in 1946.

CHARLES J. MICHAEL has been named sales promotion manager for *CRANE CO.* in the company's advertising and sales promotion department. Mr. Michael has been with the company since 1942 and since 1945 has had charge of all Crane Co. displays and exhibits. He will also supervise display and exhibit activity.

Four new managers of key marketing positions have been appointed by the Trumbull Components Dept. of *GENERAL ELECTIRC CO.* The Trumbull department was formed recently in connection with an expansion step for the company. The new managers and their departments are as follows: *A. P. McGRAW*, manager of component sales; *J. D. HOPKINS*, manager of product planning and marketing research; *J. A. KELLY*, manager of commercial service; and *H. S. HILL*, manager of internal sales.

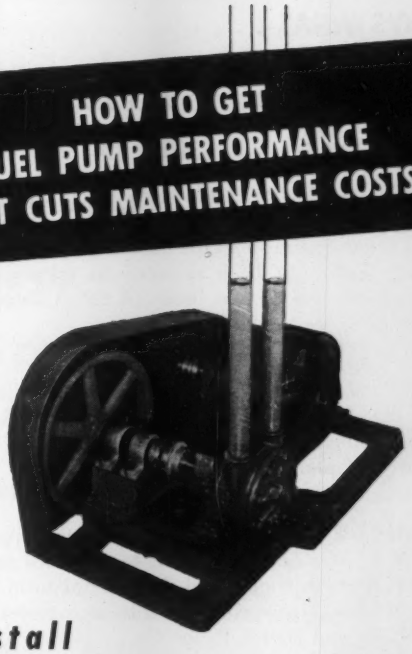
Two major executive appointments have been announced by *ACRO MFG. CO. WALTER F. ROCKWELL* was elected chairman of the board, after 33 years service as president of Timken-Detroit Axle Co., from which he retired recently. *F. G. McCLOSKEY*, formerly executive vice president and a director of Acro, has been appointed president.

NATHAN A. GARDNER has been appointed manager of air conditioning and refrigeration sales in the export department of *WORTHINGTON CORP.* Mr. Gardner has been with the company since 1945 and served most recently as assistant manager of air conditioning and refrigeration sales. He succeeds *H. E. WOOD*, who has been appointed far eastern manager of the company's export department.

RAY LITTLE has joined the *GAS APPLIANCE MANUFACTURERS ASSOCIATION* as director of sales promotion. He has been sales manager of the Equitable Gas Co. for the past nine years.

The *INSTITUTE of ENVIRONMENTAL EQUIPMENT MANUFACTURERS* has announced the election of the following officers: president, *MONROE SELIGMAN*, president, Tenney Engineering, Inc.; executive vice president, *C. M. SHELBURN*, vice president, Webber Mfg. Co.; vice president of the low temperature division, *R. S. JAMISON*, vice president, Sub-Zero Products; vice president, high altitude division, *ALBERT J. DEEB*, sales manager, International Radiant Co.; vice president special

HOW TO GET
FUEL PUMP PERFORMANCE
THAT CUTS MAINTENANCE COSTS



Install
TUTHILL TYPE SU *Pumping Units*
For Dependable Service
in Industrial Heating

Tuthill Type SU multiple V-belt pumping units provide structural and performance advantages for dependable, uninterrupted operation that add up to reduced maintenance expense.

Features like these make the SU outstanding for handling heavy fuel oils in industrial heating:

- ★ **Motors up to 5 h.p. mounted on slotted slide rails for easy adjustment or replacement. No drilling or tapping required.**
- ★ **Cast iron base with mounting bolts and adjustments easily accessible.**
- ★ **One-point belt-tension adjustment.**
- ★ **Jack shaft, supported by ball-bearing pillow blocks, carries entire weight of pulley and absorbs belt tension.**
- ★ **Pump, jack shaft and pillow blocks available as separate unit.**
- ★ **Pump and jack shaft direct-connected by flexible coupling for better alignment and simplified mounting.**
- ★ **Wide range of pump models and capacities.**

Complete data is presented in Tuthill Catalog No. 107. Write for your copy today.

TUTHILL PUMPS FOR THE PURPOSE

TUTHILL PUMP COMPANY
Dependable Pumps since 1927
939 East 95th St., Chicago 19, Illinois
Canadian Affiliate: Ingersoll Machine & Tool Co., Ltd.
Ingersoll, Ontario, Canada

WHO'S WHAT . . .

[*Continued*]

equipment division, *DAVID H. LEATHERMAN*, president, Bemco Inc.

CARVER PUMP CO. has elected *ROBERT E. TANNER* vice president and general manager of the company. Mr. Tanner also assumes the post of general sales manager, having previously been engaged in sales work for the Continental Can Co. as well as the National Can Co., where he served as vice president.

JOSEPH POMMERSHEIM has been appointed chief engineer of *ROCKWELL MFG. CO.'s* Norwalk plant. Mr. Pommersheim was formerly a project engineer at the Homewood plant.

MARLOW PUMPS has announced the appointment of *JOHN L. NORTH* as assistant to the sales manager with headquarters in Ridgewood, N. J. Prior to his association with Marlow, Mr. North worked in an engineering capacity for Hinds and Dauch Paper Co.

J. M. TOUGH has been named sales manager of *WATSON-STILLMAN FITTINGS DIV., H. K. PORTER CO., INC.* Mr. Tough has been with the company since 1942 and was most recently district manager of the Chicago territory.

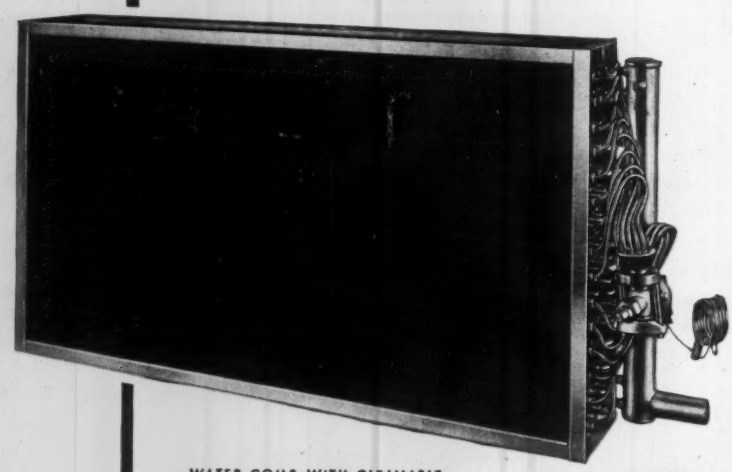
SCHNACKE, INC. has announced the appointment of *FRANK D. KLEIN* as sales manager for the firm's domestic and export sales. Mr. Klein has been with the company since 1933. He is the author of a number of books on manufacturing processes and sales.

Several new appointments have been announced by the *AUSTIN CO. HAROLD A. ANDERSON* is vice president and assistant general manager at the Cleveland office. He has been with the company since 1928 and was vice president and eastern district manager until his appointment. *ALLAN S. AUSTIN* now is vice president and general sales manager of the company, which he joined in 1928 and has served as secretary since 1941. *W. G. PATON*, vice president in charge of the steel fabricating division and technical personnel and also assistant secretary, has been elected secretary succeeding Mr. Austin and continues as a vice president. *JOHN N. BECKLEY*, who was assistant general sales manager in the New York district, has been named acting eastern district manager.

WARREN G. JENNINGS and *RICHARD ROBERTS* of the *MINNEAPOLIS-HONEYWELL REGULATOR CO.* retired recently. Mr. Jennings has been with the company for 37 years, during which time he was in charge of the

EVERY RIGIDBILT PRODUCT A MASTERPIECE OF ENGINEERING DESIGN

RIGIDBILT AIR CONDITIONING COILS



WATER COILS WITH CLEANABLE TUBES ALSO AVAILABLE

These Important Features Assure RIGIDBILT Superiority . . .

Maximum heat transfer by heavy aluminum or copper fins, heavy galvanized steel casings. Extruded fin collar entirely surrounds copper tube. Proper circuiting ratio of tonnage to tube length minimizes pressure drop, increases overall coil efficiency. Tested to 300 lb. air pressure under water. Fin spacings variable for ranges of temperature, air velocity, humidity. Tube sizes variable in height and length. Flanged and punched casings. Entire coil custom engineered.

RIGIDBILT IS BETTER BUILT—Write for Catalog

RIGIDBILT INC.

2852 W. FULTON ST., CHICAGO 12, ILLINOIS

FAST DELIVERY!

AIR CONDITIONING & VENTILATING UNITS • UNIT & PRODUCT COOLERS • HEATING & COOLING COILS
ALSO COILS DESIGNED AND BUILT FOR SPECIAL APPLICATIONS

WHO'S WHAT . . .

[*Continued*]

firm's New England operation and the management of offices in Milwaukee and Chicago. He was named a vice president in 1927. Mr. Roberts, who was with the Industrial Div. 29 years, was the division's first representative in New Jersey.

CAMBRIDGE CORP. has a newly elected president, *JOHN W. LOGAN.* Carrier Corp. and Arthur D. Little, Inc. are parent companies of the corporation. Mr. Logan was formerly with General Electric Co. for 22 years before going to Cambridge. He will succeed *DR. BRUCE S. OLD*, who will become chairman of the board of directors. Mr. Logan will also be a director of the corporation and chairman of its executive committee.

The appointment of *FRANK H. POST* as sales manager has been announced by the *ROBERTSHAW-FULTON CONTROLS CO.* Mr. Post was formerly sales manager for the domestic sales only and will now be in charge of all sales for the company's two divisions.

The company also anounces that *E. J. HORTON* will assume new duties in the firm's executive offices.

MINNEAPOLIS-HONEYWELL has announced the election of several new executives. *CHARLES B. SWEATT* has been elected to the newly created office of vice chairman of the board. Mr. Sweatt has been an executive with the company since 1945 and was most recently executive vice president. *TOM McDONALD* and *A. M. WILSON*, formerly vice presidents, are now executive vice presidents. Mr. Wilson was in charge of the firm's aeronautical division and Mr. McDonald was chief of world wide sales for the organization.

The firm also announces that *JOHN A. HILL* has been appointed assistant to the personnel manager. Mr. Hill will be primarily concerned with activities relating to engineering personnel and the company's relations with colleges.

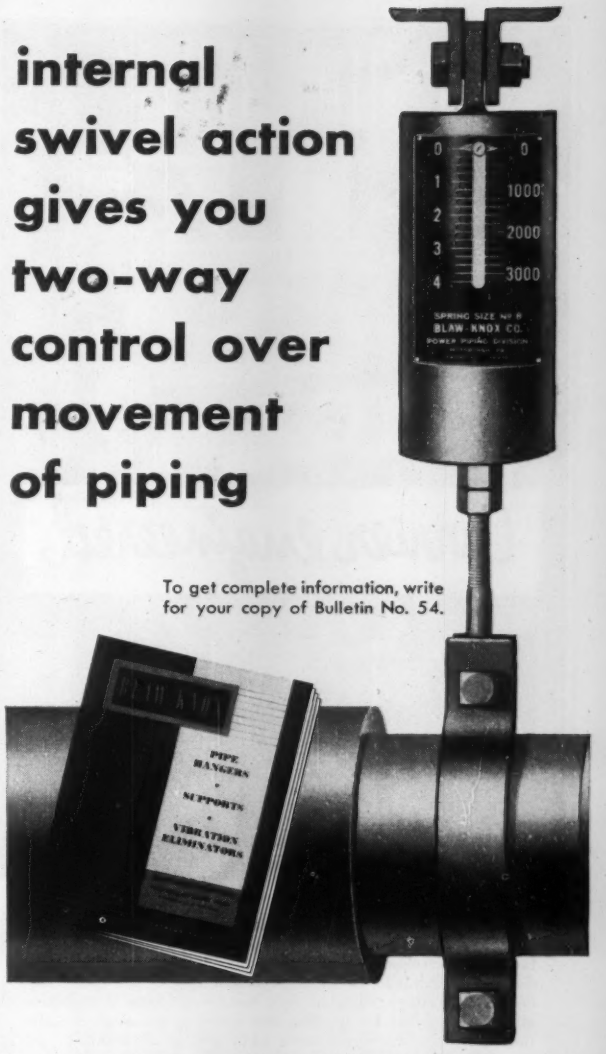
A. O. JAECKEL has been elected president of *DAVIS ENGINEERING CORP.* He will continue to serve as general manager. *FRANK F. KUNCA* was elected treasurer of the company.

IN THE TERRITORIES . . .

For *CORY CORP.*—Two new territory managers. *ROBERT W. BALES* will handle sales of air conditioners and air treatment appliances throughout southern Texas from the Louisiana border to San Angelo and Waco to Brownsville in the southern Texas territory. *JOE TODD* will be in charge of sales in the states of North and South Carolina.

For *WARREN WEBSTER & CO.—DWANE E. BUSSE* was appointed representative for the St. Louis territory. This territory was formerly handled by the Hester-Bradley

internal swivel action gives you two-way control over movement of piping



To get complete information, write for your copy of Bulletin No. 54.

You can readily control both the lateral and longitudinal swing movements of your piping up to 7° with our functional spring hanger.

For the hanger is designed with the Blaw-Knox patented *internal swivel action*, which permits movement while the hanger case itself remains vertical. Larger movements are readily accommodated by overhead roller assemblies. Each is a complete packaged unit ready to install.

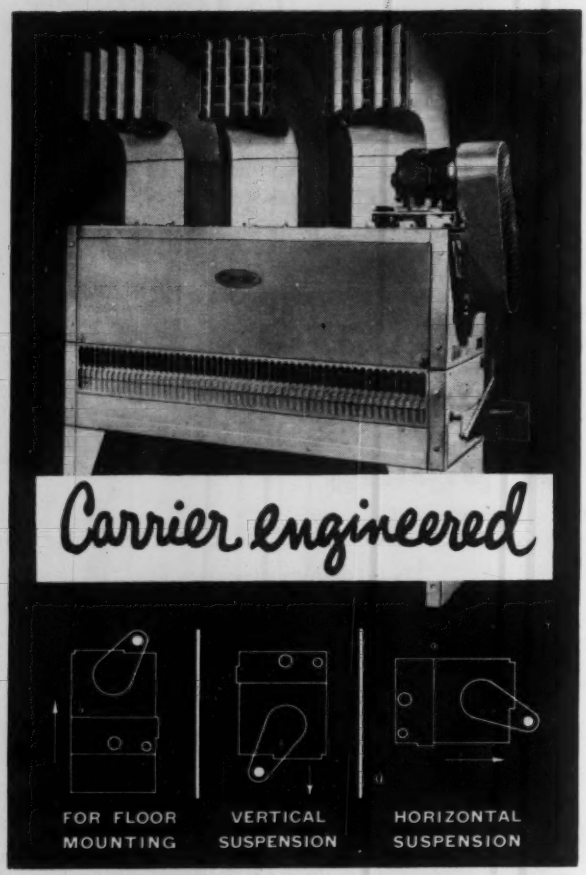
In fact, our entire line of rigid hanger assemblies, overhead roller assemblies, vibration eliminators, as well as the functional hangers, are furnished as complete units . . . thereby saving you engineering time and eliminating expensive cutting, threading and assembling in the field.

Our engineers, who have had many years of experience, are available to both design and make recommendations for your hanger requirements.

BLAW-KNOX COMPANY • Power Piping and Sprinkler Division, Pittsburgh 33, Pa.

BLAW-KNOX **PIPE HANGERS**

Complete line of functional spring hangers • rigid hanger assemblies • overhead roller assemblies • supports • vibration eliminators . . . plus complete prefabricated power piping systems for all pressures and temperatures.

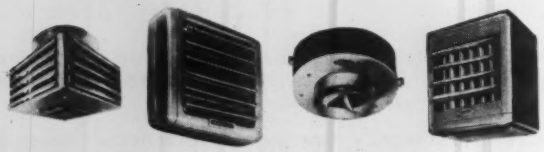


CARRIER Heating and Ventilating Units offer the most economical method of heating and ventilating large areas in factories, warehouses, garages, hangars, commercial and industrial buildings. In three sectional types—six basic sizes each, with either right or left hand coil connections—they afford a flexibility for meeting any steam or hot water installation and capacity requirement (115,000 to 2,390,000 Btu per hour). Accessories include complete line of filter boxes, intakes, diffusers and controls.

Three basic factors give these units outstanding qualities for efficiency and long life: (1) *Highly skilled engineering.* (2) *High-grade materials.* (3) *High standard manufacture.*

For example: All sections are die-formed from heavy-gauge steel and integrally welded. Fans are special design multi-blade, double inlet centrifugal blower type. Fan wheels are die-formed steel, electrically welded, statically and dynamically balanced. Self-aligning, dust-proof fan shaft bearings. Heating coils are copper tube with aluminum fins.

For complete list of features and selection data, WRITE to Carrier Corporation, Syracuse, New York.



Carrier also makes a complete line of Unit Heaters for steam and hot water; and Gas-fired Unit Heaters in propeller-fan and duct types.

Carrier

AIR CONDITIONING
REFRIGERATION
INDUSTRIAL HEATING

WHO'S WHAT . . .

[*Continued*]

Co., who employed Mr. Busse as a sales engineer. Hester-Bradley now is a promotional jobber for Mr. Busse. The new organization has established an office at 6219 Delmar Boulevard, St. Louis 5, Mo.

For the *SWARTWOUT CO.*—The Los Angeles district office now is handling all sales and service matters pertaining to the company's "Autronic" control and power plant equipment divisions, including special accounts previously handled by Charles P. Crowley. *ROGER P. GILLILAND* is in charge of the new office, which will service southern California, Arizona, and Clark County, Nevada and will be located at 317 West Main St., Alhambra, Calif.

For *CHRYSLER CORP., AIRTEMP DIV.—JAMES B. CLOW & SONS* has been appointed warehouse distributor of air conditioning equipment in northern Illinois, including Chicago. *GERALD R. KINNALLY* will have charge of the office in Chicago.

For *S. T. JOHNSON CO.—JOHN P. MEHLHOPE* is sales engineer for *H. LIEBLICH & CO.*, distributors of oil burners for the company. Mr. Melhope's territory includes the New York and New Jersey metropolitan areas.

For *MARLO COIL CO.*—New sales representative is *GILBERT ENGINEERING CO.*, headed by *LESLIE S. GILBERT*, president. The firm will handle sales in the northeast Texas area.

For The *TUBULAR PRODUCTS DIV.* of the *BABCOCK & WILCOX CO.—E. T. WILSON, JR.* has been appointed sales representative for the Oregon, Washington, British Columbia, Alberta and Saskatchewan area. Prior to his appointment, Mr. Wilson was purchasing agent for the Cascade Mfg. Co. His office will be located at 1432 S. W. Sixth Ave., Portland, Ore.

For *BINKS MFG. CO.*—New representative for cooling towers is *WHITE SALES ASSOCIATES* headed by *C. S. WHITE* and his associate, *L. L. LAYMAN*. The company will cover the Cincinnati territory with offices at 1416 Central Parkway.

Two new district sales managers have been appointed for *EBCO MFG. CO.—JOHN M. HARRIS* will handle sales in southern Illinois, Missouri, Kansas, Nebraska, and western Tennessee. *WILLIAM O. CORFIELD* will handle sales in northern Illinois, Iowa, Wisconsin, Minnesota and the Dakotas, with headquarters in Chicago.

For the *RIDGE TOOL CO.*—Several changes have been made in sales representatives. *C. O. HOLLEN* has announced his retirement from the company. Taking his place is *RALPH W. HAMLIN*, who will handle sales in New Jersey, Pennsylvania east of Lewistown, and Wilming-

GUARD AGAINST LEAKING OIL TUBES

End CONTAMINATING OF BOILERS AND HEATING SYSTEMS . . . WITH THE

. . . suitable for both suction side or pressure side hookup

ALSTROM "SAFE GUARD" OIL PREHEATER

This "Safe Guard" Double Transfer Unit gives uniform heating at correct temperatures, with maximum efficiency • compact • ruggedly constructed • triple tested • Visual Indicator, standard on all models

Every "Safe Guard" Oil Preheater is equipped with necessary connections for either below-water-line installation or *Vacuumatic installation.

Write for literature

- completely "fuel-proof!"
- really heats oil!
- assures absolute protection

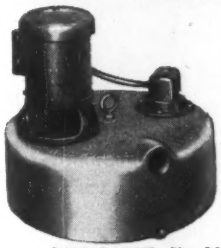
Approved by THE NEW YORK CITY BOARD OF STANDARDS AND APPEALS NO. 425-51-SA

*Reg. U.S. Pat. Off.

*VACUUMATIC TANKLESS WATER HEATERS • HEAVY DUTY SUBMERGED COILS • CONVERTORS • OIL PREHEATERS • STEAM COILS • TANKLESS GENERATORS • HEAT RECLAIMERS • WATER CHILLERS • AFTER COOLERS

THE ALSTROM CORPORATION
790 EAST 176 STREET · NEW YORK 60, N. Y. · CY 9-2310

LOW PRESSURE SYSTEM *Condensate Pumps*



SINGLE UNIT—Fig. 302A
10 Gal. Receiver for Single Units
Diameter 21"
Hgt. of Return above floor 6⅞"

Capacities 500 to 10,000 sq. ft. E.D.R.

weil TVC PUMP

LOW RETURN CONNECTION
LOW SPEED, LONG LIFE
CAST IRON RECEIVER
LOW WATER LINE
ELECTRODE OR FLOAT SWITCH CONTROL

DUPLEX UNIT—Fig. 303B
15 Gal. Receiver for Single or Duplex Units
Diameter 25½"
Hgt. of Return above floor 7 3/16"

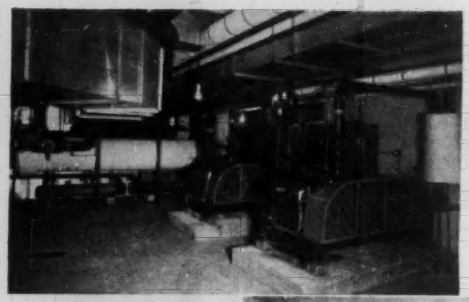
TVC SELECTION TABLE

Unit Number	Max. Sq. Ft. E.D.R.	Discharge Pressure At Pump	G.P.M. From Radiation	Cap. of Pump	H.P. of Motor	Return Inlet	Pump Discharge	Dia. of Receiver	Height of Unit
TVC 13	500	20 lbs.	.25	1.0 GPM	1/4	2"	1"	21"	21"
TVC 19	750	20 lbs.	.38	1.5 GPM	1/4	2"	1"	21"	21"
TVC 23	1000	20 lbs.	.5	1.5 GPM	1/4	2"	1"	21"	21"
TVC 29	2000	20 lbs.	1.0	3.0 GPM	1/4	2"	1"	21"	21"
TVC 35	4000	20 lbs.	2.0	6.0 GPM	1/4	2"	1"	21"	21"
TVC 41	6000	20 lbs.	3.0	9.0 GPM	1/2	2"	1"	21"	23½"
TVC 47	8000	20 lbs.	4.0	12.0 GPM	1/2	2"	1"	25½"	23½"
TVC 52	10000	20 lbs.	5.0	15.0 GPM	3/4	2"	1"	25½"	27½"

See Bulletin TVC-300-C for Full Specifications

Intermediate Sizes Based Upon Discharge Pressure Required Are Available.

weil PUMP CO. 1514 NORTH FREMONT ST., CHICAGO 22



need refrigeration you can rely on?

CHECK with VILTER

One of the most modern hospitals in the Middle West is the United States Army Veterans Hospital at Omaha. Latest medical techniques are employed here, while laboratories in the hospital constantly are conducting research for new and better treatments. An interesting feature of the hospital is its photographic laboratory. A photographic record—sometimes in color—is kept of patients to show their progress from the time they are admitted until they are discharged. Important parts of the building are air conditioned, and Vilter compressors provide the refrigeration.

Among the air conditioned portions are ten operating rooms, six recovery rooms, six allergy rooms, eight X-Ray rooms, central supply rooms, laboratories, drug room, admittance operating room, and the doctors' offices and lounge. Two Vilter VMC Compressors provide a total of 128 tons of refrigeration.

Hospitals need refrigeration they can rely on . . . but so do food plants, meat packers, brewers, cold storage warehouses, and most other refrigeration applications. You see Vilter so many times in these important applications, because architects, engineers, and contractors know that Vilter refrigeration *keeps on running*. And does it with lower operating and upkeep costs in the bargain.

Vilter®

Your nearby Vilter Distributor or Representative will be glad to show you why Vilter is more reliable —economically.

REFRIGERATION and AIR CONDITIONING

THE VILTER MANUFACTURING COMPANY
MILWAUKEE 7, WISCONSIN

Air Conditioning • Ammonia & Freon Compressors • Booster Compressors • Baudelot Coolers • Double Pipe Coolers • Blast Freezers • Evaporative & Shell & Tube Condensers • Pakicers • Pipe Coils • Valves & Fittings

WHO'S WHAT . . .

[*Continued*]

ton, Del. *M. B. WILLIAMS* takes over sales in the District of Columbia, Maryland, Delaware (except Wilmington), Virginia and North Carolina.

For the *ALDRICH CO.*—*J. W. CALHOON* has been appointed sales representative in Iowa, Nebraska, Kansas and western Missouri. Mr. Calhoon formerly handled the Meyer Furnace Co.'s wholesale accounts.

For the Machinery Div., *DRAVO CORP.*—The Cleveland office now is located at 4207 Chester Ave. This office handles the sale of heating and air conditioning equipment. *WALTER R. HOFFMAN* is district manager.

For *BAILEY METER CO.*—The Boston district office has been moved to new quarters at 230 Congress St. *P. T. REUTER* is the manager. This office serves the states of Rhode Island, Massachusetts, Vermont, Maine, New Hampshire, and Connecticut.

SID HARVEY has taken over the business formerly operated by County Supply Co., Inc., 638 Southbridge St., Worcester, Mass. This company has been a jobber for Sid Harvey, and will carry a full supply of the replacement parts for automatic heating equipment. It will operate as a Sid Harvey branch.

For *ALLIS-CHALMERS MFG. CO.—CENTRAL AIR CONDITIONING & HEATING, INC.* has been named a distributor of pumps in several counties of Tennessee, with headquarters at 924 8th Ave., S., Nashville.

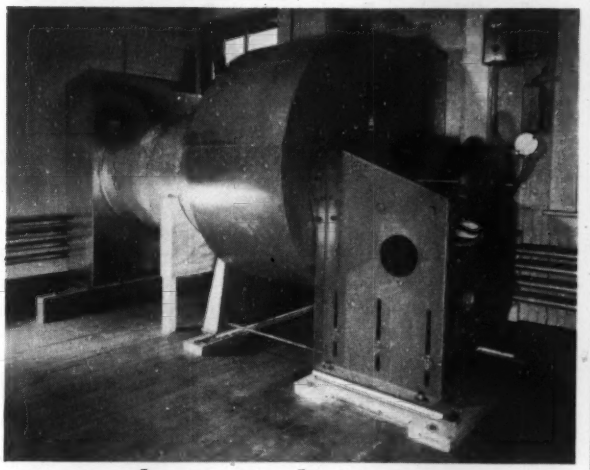
For the *NATIONAL RADIATOR CO.*—New sales representative in the Jackson, Miss. area is *ENGINEERING SALES CO. W. V. POTTS* is in charge of the new office at 550 Grandview Circle.

For *A. O. SMITH CORP.*—Two new regional managers of the east and west coast district offices. *WALTER W. STAKE* is the new regional manager for the eastern district, succeeding the late Russell J. Irish. *ALLEN O. DRAGGE* is regional manager of the Pacific coast district. He formerly had jurisdiction over west coast operations.

For *DRAYER-HANSON, INC.*—A new regional branch office has been established in the metropolitan New York area with offices at 101 Park Ave. *GENE KOSKI* will head the new office.

For *WOLVERINE TUBE DIV.* of *CALUMET & HECLA, INC.*—Two new sales representatives. *SAM ROBB* will be located at the New York headquarters at 60 E. 42nd St. *W. G. ROBERTSON* will be located in the Rochester office in the Sibley Tower Bldg.

THIS FAN *had* TO BE SILENT



so they *isolated* it on BARRY FAN BASES

Carter's — the famous makers of fine underwear for the entire family — had to install this large ventilating blower on a mill-construction floor, directly above executive offices. From previous experience with similar installations, the plant superintendent expected plenty of complaints about vibration and noise.

> The installation was made, using the new Barry custom-built vibration isolating bases — and there have been *no* complaints of any sort. At all operating speeds, the vibration of the heavy motor and fan is thoroughly isolated from the supporting floor. Even though the flooring is of relatively light mill construction, it gets no chance to act as a sounding board.

Barry fan bases are the ideal choice for the toughest jobs of isolating vibration and noise caused by any type of heating and ventilating or air-conditioning equipment. Each base is a *custom* job, specifically designed for the equipment it will carry. That is why these bases can be backed by a money-back guarantee. That is also why Carter's — with a tricky installation problem solved — is another satisfied user of Barry fan bases.

If transmitted noise and vibration is YOUR problem, we can help you. Write TODAY for your free copy of Bulletin 539.

Barry Quality

THE BARRY CORP.
782 Pleasant Street,
Watertown 72, Mass.
Sales Representatives in Principal Cities

BRIEFS
From *The Yeoman's Guard*

"PNEU-PUMP" SOLVES SMALL-VOLUME PUMPING PROBLEMS

The "Pneu-Pump" is a pneumatic pump that handles small volumes with the same efficiency normally found only in higher-capacity pumps. It is simple to install, automatic in operation. As it has only one moving part, the "Pneu-pump" is practically foolproof. Price: agreeably low.

Bonus features are immunity to high temperatures and ability to pump even such problem-materials as oil, mud, paint, tar, acids, alkalis, sludge, slurries and abrasive liquids.

Definitely worth investigation — whether for drainage duty or special duties.

☐ Please send "Pneu-Pump" Bulletin.

Respected Old Ritz-Carlton Hotel, Sleek New Walban Apartments —

BOTH RELY ON YEOMANS PUMPS

- *Famous for their tradition of service — the Ritz-Carlton, and Yeomans Pumps*

Among the real oldtimers on the service-conscious staff of the Ritz-Carlton Hotel, Philadelphia, are two Yeomans vertical centrifugal sump pumps *installed in* 1912 . . . and still in quiet, efficient operation.

- *Clean, functional, modern design — the Walban Apartments, and Yeomans Pumps*

"Modern as tomorrow" is an apt description of the new Walban Apartments 5-building group in Painesville, Ohio. Equally as modern as the site utilization concept and architecture employed is the choice of mechanical equipment for the buildings . . . including Yeomans duplex centrifugal sewage ejectors, which are used exclusively.

For more information on the newest developments in vertical centrifugal pumps by the company with the oldest reputation for service . . . check the box below.

☐ Please send Vertical Centrifugal Pump Bulletin 3-8001.

Motopump Features Access to Impeller *without disturbing discharge piping*

Like all Yeomans pumps, the Motopump — a close-coupled, heavy-duty centrifugal — is designed to need as little service as possible, and to make that "little" as easy as possible.

- **To get at the impeller, you simply remove a suction cover; an important design feature because 75% of centrifugal pump troubles (by analysis of service reports) trace to the suction side.**

Removing the cover does not disturb any other parts. A self-lubricating mechanical seal eliminates leakage that occurs with a conventional packing box.

Bulletin 1120 has complete Motopump information, including drawings. Call your local Yeomans representative — or write us.

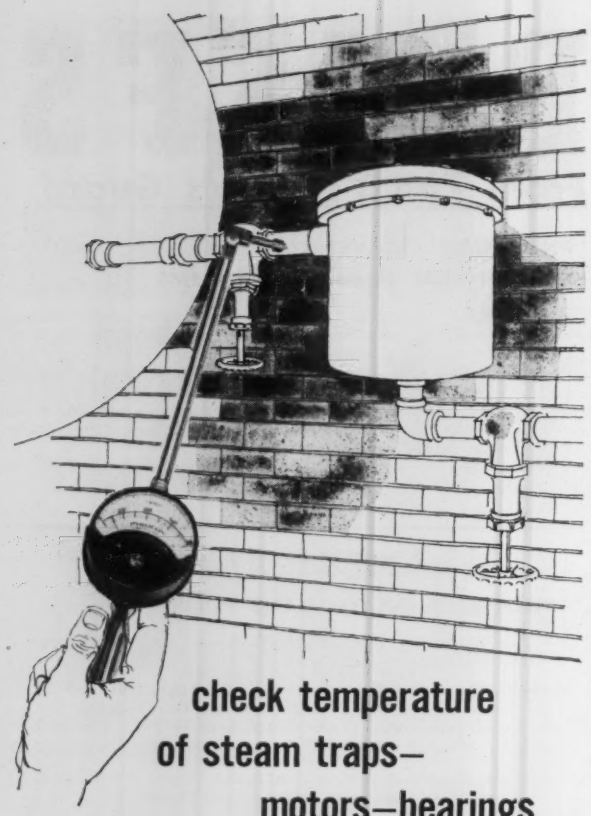
☐ Please send Bulletin 1120.

The Yeomans Guard, our periodical, carries the full Ritz-Carlton and Walban Apartments stories . . . as well as other news and helpful information on pump selection, applications and maintenance. A copy of the current issue is available on request from your local Yeomans Representative (listed in the telephone book Yellow Pages under "Pumps") . . . or check box below and mail this advertisement to us. Be sure to give us your name, company name and address.

☐ Send current issue of "The Yeomans Guard."

YEOMANS BROTHERS COMPANY

2000-5 N. Ruby St., Melrose Park (Chicago), Illinois



check temperature of steam traps— motors—bearings

. . . quickly and accurately with the Alnor Pyrocon, the portable contact pyrometer for taking surface temperatures. This handy, portable instrument can be your most useful maintenance and installation tool . . . it provides accurate temperature readings instantly of any surface (metallic or non-metallic), flat, curved, stationary or revolving.

It's a well-balanced instrument mounted in a sturdy case for protection against the usual hazards of on-the-job service. Jeweled movement is also heavy-duty, shock-resistant type that will withstand hard and continuous use . . . performing with laboratory accuracy.

A wide selection of thermocouples and extension arms assures its adaptation to your needs. Eight standard F. scale ranges are available up to 1200°F. Send for complete details contained in Bulletin 4257. Illinois Testing Laboratories, Inc., Rm. 513, 420 N. LaSalle St., Chicago 10, Ill.

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NEW BOOKS & REPORTS . . .

Air Conditioning, Refrigerating Data

Air Conditioning, Refrigerating Data Book is one of a continuous series of data books published by ASRE. It is the eighth edition of the volume on Design or fundamentals covering the theory, principles and basic engineering information used in the design of refrigerating equipment and refrigerating and air conditioning systems.

The words "Air Conditioning" have been added to the title as a contemplated permanent change for both the Design and Applications volumes, since considerable data on air conditioning is included in both books. The chapters in this edition have been rearranged from the sequence used previously and new section headings have been applied in an effort to consolidate the material and avoid duplication.

New chapters on the heat pump, absorption and steam jet units, and abbreviations and symbols have been added. The chapters on fluid flow and viscosity, piping, and testing and charging were completely rewritten, and major additions or revisions were made in several of the other chapters. The chapters on insulation and moisture proofing; on evaporators; on fans, ducts and filters; and on controls consist of combinations of chapters in the former edition with certain revisions. The former chapter on commercial refrigerators was omitted since this data is in the Applications volume.

The book may be obtained from the American Society of Refrigerating Engineers, 40 W. 40th St., New York 18, for $7.50 a copy.

Principles of Economical Heating

The National District Heating Association in collaboration with the National Association of Building Owners and Managers has recently released the fifth edition of the *Principles of Economical Heating*. The booklet covers the economical use of steam for heating buildings and presents various methods of eliminating heat waste. Many principles given are applicable to heating systems regardless of the source of the supply of heat. Some are suitable only when district-steam service is used. Methods are suggested for operating existing facilities to effect greater comfort and economy. Some of the subjects covered are, briefly: heat saving, building heat loss, building heating systems and parts, common faults of heating systems, hours of heating, temperature control, steam distribution, heating requirements and efficiency and service-water heating.

Single copies of the booklet are 35 cents and may be secured from the National District Heating Association at 827 N. Euclid Ave., Pittsburgh 6, Pa.

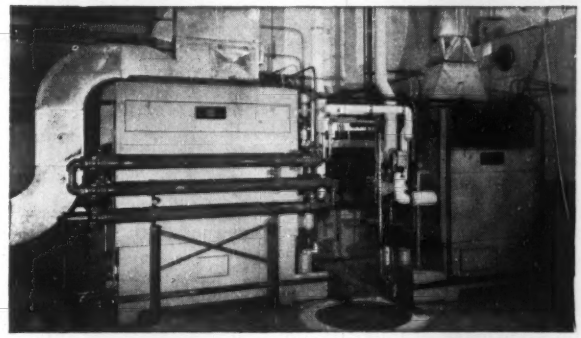
Industrial Water Conditioning

Recently published, the fourth edition of the *Betz Handbook of Industrial Water Conditioning* is designed to offer a practical text for reference and study of the latest developments in water technology.

The introductory chapters of the handbook deal with basic water treatment processes such as aeration, coagulation, softening, etc. The following chapters are concerned with specific water problems, particularly prob-

This NEW METHOD DRIES AIR

PRECISELY AS YOU WANT IT



NIAGARA CONTROLLED HUMIDITY AIR CONDITIONING

This method removes moisture from air by contact with a liquid in a small spray chamber. The liquid spray contact temperature and the absorbent concentration, factors that are easily and positively controlled, determine exactly the amount of moisture remaining in the leaving air. Heating or cooling is done as a separate function.

The Niagara's Controlled Humidity Method using HYGROL moisture-absorbent liquid is

Best and most effective because . . . it removes moisture as a separate function from cooling or heating and so gives a precise result constantly and always. Niagara machines using liquid contact means of drying air have given over 20 years of service.

Most reliable because . . . the absorbent is continuously reconcentrated automatically. No moisture-sensitive instruments are required to control your conditions.

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The cleanest because . . . no solids, salts or solutions of solids are used and there are no corrosive or reactive substances.

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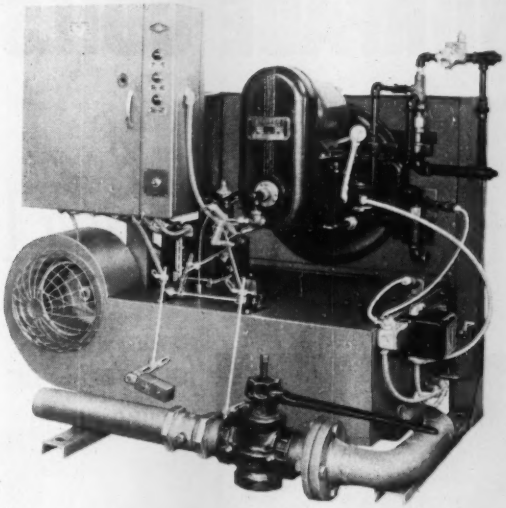

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- √ **Sizes from 75 to 300 horsepower.**
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- √ **Approved electronic combustion safeguard system.**
- √ **Simpler changeover than ever before.**
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- √ **Completely assembled, piped, wired and tested.**

These and many other outstanding features combine to provide the same dependable high quality performance as the WEBSTER DYNETIC gas burner. Neither fuel must suffer if the WEBSTER ROTONETIC is used. With integral pumps, integral oil preheaters for heavy oils, patented oil burner "flame-shaping" vanes, and full modulating or optional high-low control, the WEBSTER ROTONETIC is designed to provide long lasting customer satisfaction the year around.

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Drayer-Hanson EXTENDED SURFACE COILS are noted for their performance!

The key to performance is ample prime and secondary surface. Compare D-H coils with others!

for heating or cooling using steam...water... or direct expansion!

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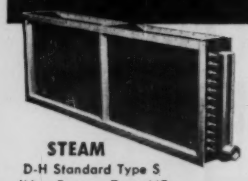
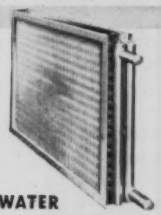
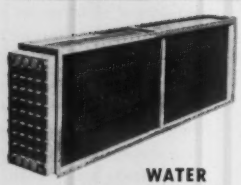


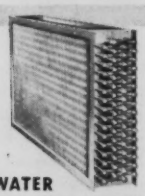
STEAM
D-H Standard Type S
(Non-Freeze, Type NF also available)



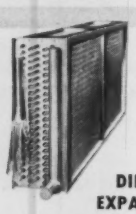
WATER
Continuous Tube, Type CT



WATER
Removable Header, Type RH



WATER
Removable Plug, Type OR



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NEW BOOKS & REPORTS . . .

[*Continued*]

lems encountered in boiler water and cooling water conditioning. Applications and limitations of various water-treating equipment and methods are covered in detail.

To guide plant engineers and chemists in handling and supervising water conditioning operations, a supplementary section of the handbook is devoted to control water analyses and their interpretation.

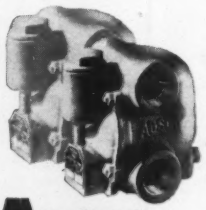
It is priced at $3.00 and may be ordered from W. H. & L. D. Betz, Gillingham & Worth Sts., Philadelphia 24.

Steam and Gas Turbines

Theory and Design of Steam and Gas Turbines is a complete and fundamental treatment of steam and gas turbines. The book is mainly concerned with two things: one, to provide a textbook for use in graduate and undergraduate mechanical engineering curricula which will force the student to make extensive use of the fundamental knowledge acquired in the basic courses; and two, to furnish the practicing mechanical engineer with a fundamental background.

Author of the book is John F. Lee, associate professor of mechanical engineering, North Carolina State College.

Descriptive matter is introduced only to the extent necessary to establish physical concepts in the mind of the student. The theory common to all comprehensible-fluid machinery is treated first, with extension and application of the theory to steam turbines, gas turbines, axial-flow



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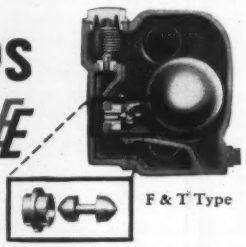
WHEN the valve and valve seat of an ADSCO Dual Steam Trap become worn, neither these parts nor the trap itself need to be replaced. Merely reverse the valve and seat by a simple operation and you double the life of the trap...

DUAL TRAPS LEAD A DOUBLE LIFE



F & T Type

...And here's another great feature of ADSCO Traps. All working parts are mounted on the cover. Pipe connections do not have to be broken for inspection or service...ADSCO Dual Steam Traps are extremely compact with large capacity. Dual inlet and outlet connections reduce installation costs. In the type shown here, an internal thermostatic element provides an automatic air bypass...For complete information, call an ADSCO representative or write the factory.

AMERICAN DISTRICT STEAM COMPANY, INC.
NORTH TONAWANDA, NEW YORK
Since 1877

NEW BOOKS & REPORTS . . .

[*Continued*]

compressors and centrifugal compressors. Combustion is treated from a fundamental standpoint. Steam and gas turbine power cycles are completely treated both from the ideal and non-ideal standpoints.

The 500-page book is priced at $9.00 and is published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36.

Careers in Engineering

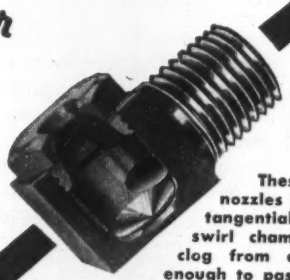
The Engineers' Council for Professional Development, which is a conference sponsored by eight national professional engineering societies, has recently published a booklet, *Engineering, A Creative Profession*, aimed at giving basic information to prospective engineering students. The text is presented in a question and answer form, with the student asking questions pertaining to the various engineering specialties and a graduate engineer providing the answers.

Some of the subjects covered include the contributions of engineering to civilization, common problems in all fields of engineering, educational requirements and job opportunities.

Another section of the booklet deals with the types of work performed by the major branches of engineering such as civil, mining and metallurgical, mechanical, electrical and chemical.

Copies of the book may be ordered from the ECPD, 29 W. 39th St., New York 18, at 25 cents a copy.

Monarch
NOZZLES
for
AIR WASHERS



These are "non-clogging" nozzles with a single large tangential lead hole to the swirl chamber that will never clog from any impurities small enough to pass through the orifice. Swirl chamber is conical on both ends and pivots liquid like a top to produce an exceptionally fine, evenly distributed, balanced spray of about 80° included angle. Wider spray angles up to 130° can be furnished to order.

Standard material Brass. Also available in Stainless Steel and Monel. Pipe sizes from 1/8" to 1". 1/4" size is 1-5/16" long and made from 3/8" square stock.

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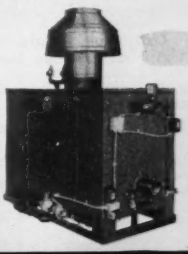

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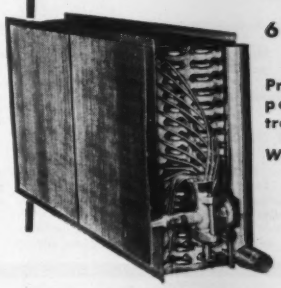

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Precision built to insure top performance and to give trouble-free service.

Write for bulletins and prices.

Complete facilities for fabrication of pipe coils — all types — all materials. Engineering service. Send details for price.

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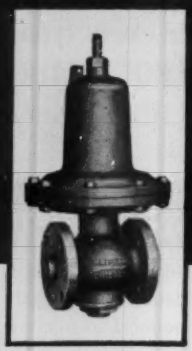

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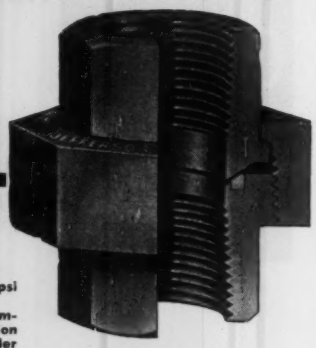

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. . . a "MORE" complete line. . including Unions, Union Elbows and Union Tees in Jefferson 300#, Excel 250# and Master 150#; also Flanges in Jefferson 300# and Unions in Enduro 300#. All lines also available with all-iron seats. Underwriters approved.

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OTHER BOOKS & REPORTS . . .

EFFECT OF POLYPHASE MOTORS ON THE VOLTAGE REGULATION OF CIRCUITS SUPPLYING THREE-PHASE WELDER LOADS—results of the investigation of voltage regulation problems, such as light flickering, due to the use of resistance welding machines. The booklet was prepared by Max A. Faucett, Marvin Fisher, Jr., and M. Stanley Helm, all of the Dept. of Electrical Engineering Dept. at the University of Illinois.

Published by the University of Illinois Engineering Experiment Station, Urbana, it is priced at 40 cents.

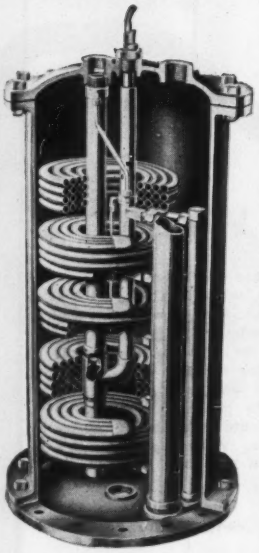
CLIMATIC DATA OF NORTH CAROLINA, For Use By Engineers, Architects and Contractors—a bulletin prepared by the Dept. of Engineering Research of North Carolina State College for those who are concerned with the design, installation, maintenance or sale of heating and air conditioning equipment within the state. Climatic conditions and design data are covered. Author is T. C. Brown, associate professor of mechanical engineering.

Copies are priced at 50 cents and may be ordered from the college, Raleigh, N.C.

PILOT PLANT CATALYTIC GASIFICATION of HYDROCARBONS—results of a pilot plant investigation of the catalytic cracking of hydrocarbons of low molecular weight, in the presence of steam and air, as a method of producing equivalents of various types of utility gases, manufactured and natural.

Copies are available from the Institute of Gas Technology, 17 W. 34th St., Technology Center, Chicago 16, for $5.00.

AERCO COMPACT STORAGE WATER HEATER



Takes the place of large storage tanks under most conditions.

An abundant supply of hot water at even temperature under varying load conditions with low steam consumption and no surging of steamflow. The design allows the regulator to sense changes in quantity of incoming cold water BEFORE the water actually passes over the heating surfaces, thereby ANTICIPATING the new requirements of steam flow.

Write, wire or phone as to how you can effect substantial savings in cost.

- ***Minimum storage volume* for peak demands.**
- ***Minimum steam input* for required load.**
- ***Accurate* controlled outlet water temperature under *all* load conditions.**

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MEETINGS & CONVENTIONS...

IBR SCHOOL OF MODERN HEATING — February 9-11, Ames, Iowa, Iowa State College, Memorial Union Bldg.; February 15-17, Columbus, Ohio, YMCA, 40 W. Long St.; March 2-4, Waterbury, Conn.; March 9-11, Albany, N. Y., Odd Fellows Hall, 46-48 Beaver St.; March 16-18, Newark, N. J., Public Service Auditorium, 70 Park Pl.; March 23-25, Richmond, Va.; March 30-April 1, Norfolk, Va.; April 6-8, Philadelphia.

Tuition for the IBR School is $28.00. Students wishing further information may obtain it from the Institute of Boiler and Radiator Manufacturers, 60 E. 42nd St., New York 17.

The *NATIONAL WARM AIR HEATING AND AIR CONDITIONING ASSOC.* has announced the schedule of the *SEVEN COLLEGE SHORT COURSES* for 1954. The dates, locations and names of the persons to be contacted for reservations are:

February 15-18, Oklahoma A & M College, Prof. R. R. Irwin, School of Mechanical Engineering, Stillwater; March 3-6, Purdue University, Prof. Merle McClure, Div. of Adult Education, Lafayette, Ind.; March 29-April 1, Michigan State College, Prof. C. H. Pesterfield, Mechanical Engrg. Dept., East Lansing; April 14-17, Penn State College, T. A. Wright, Room 103, Mechanical Engrg. Dept., State College, Pa.; April 19-21, Syracuse University, Prof. J. A. King, Mechanical Engrg. Dept., Syracuse, N.Y.; April 21-24, Iowa State College, Prof. Marvin Gould, Engrg. Extension Service, Ames; July 13-16, University of Wisconsin, Prof. R. C. Tegtmeyer, Mechanical Engrg. Dept., Madison.

Each course will present basic problems in combination heating and cooling and problems in advanced heating

FOR HEAVY-DUTY HEATING IN FACTORIES, WAREHOUSES, OFFICES

Ceiling mounted CHROMALOX Electric Blower-Type Heaters are your quick, easy answer to space heating! Twin centrifugal fans, driven by a 3-phase motor, distribute warmth evenly over large areas. Air ducts can be used to convey heated air to desired locations. Automatic thermal cutout assures protection against overheating. 51,180 to 136,480 BTU output per hour.

HAVE A HEATING PROBLEM OF ANY KIND?

Then write for Catalog 50. It's loaded with information on many of the 15,000 types, sizes and ratings of Chromalox Heating Units and Equipment.

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ELECTRIC HEAT FOR MODERN INDUSTRY

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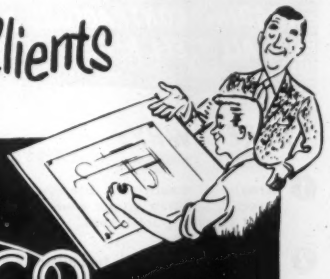

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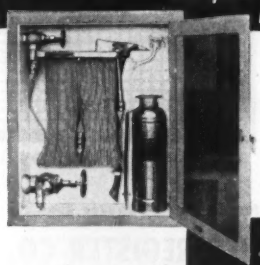

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FREEZE-PROOF Steam Traps

for Every Plant Use

Because they drain completely when cold, these four types of Nicholson steam traps are positively freeze-proof. Can be freely installed outdoors. Universally recommended for use in lines which need not be in continuous use during cold weather, because they are freeze-proof and because their 2 to 6 times average drainage capacity results in minimum heat-up time. The non-air-binding feature of Nicholson traps also notably facilitates heat transfer in severe weather. Sizes ¼" to 2"; pressures to 250 lbs.

BULLETIN 853

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TRAPS · VALVES · FLOATS

• 690¾ hours in time
• $317.83 in materials

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by
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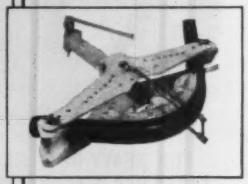
Savings on the first 100 bends repaid the *entire* cost of this Tal ONE-SHOT Bender—used in the heating installation for the S. Clement Ave. School in Milwaukee. 583 90° bends were made in 1" to 3" steel pipe, and 450 90° bends in ⅜" to ¾" hard copper tubing. This saved 2066 welds or threads, plus 1033 cuts and the cost of fittings and scrap pipe—BECAUSE a Tal ONE-SHOT completes bends in *one single operation.* It is not necessary to shift pipe.



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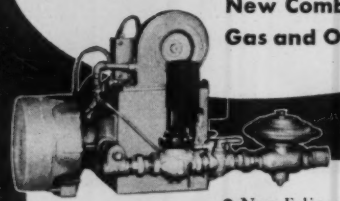

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MEETINGS & CONVENTIONS . . .

[*Continued*]

or advanced air conditioning. Commercial heating and cooling will be covered. The general fee for each school is $25.00.

INDUSTRIAL VENTILATION CONFERENCE—Third annual conference, February 22-25, Kellogg Center, East Lansing, Mich. The meeting is sponsored by the Div. of Occupational Health of the Michigan Dept. of Health, and the School of Engineering of Michigan State College. Titles of talks to be presented are:

Ventilation Practices—Then and Now; Air Flow Measuring Instruments; Inside the Industrial Ventilation Manual; Engineering a High-Velocity Duct System; Sampling and Air Contaminants; Design and Application of Dust Collection Equipment; Effect of Fan Connections on Performance; A Survey of Industrial Ventilation Practices; and Comfort Ventilation and Make-up Air.

Some design problems to be discussed include fundamentals of air flow and design of balanced duct work, design of more complex exhaust systems, and the application of ventilation control to various operations in typical industrial plants.

REFRIGERATION and AIR CONDITIONING CONTRACTORS ASSOC., 2108 Keith Bldg., Cleveland 15—Regional convention for west coast members, March 11-13, California Municipal Auditorium, Long Beach. It will be held in conjunction with the *ARI* Educational Conference.

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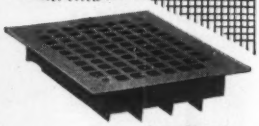

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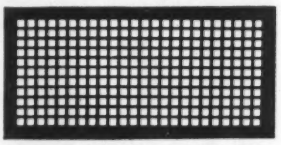

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MEETINGS & CONVENTIONS . . .

[*Continued*]

NATIONAL ASSOCIATION OF CORROSION ENGINEERS, 1061 M & M Bldg., Houston 2—Tenth Annual Conference and Exhibition, March 15 to 19, Kansas City, Mo. Co-chairmen are F. L. Whitney, Jr., Monsanto Chemical Co., St. Louis, and H. L. Bilhartz, the Atlantic Refining Co., Dallas.

AMERICAN INDUSTRIAL HYGIENE ASSOC., 205 N. LaSalle St., Chicago 1—1954 Industrial Health Conference, April 26-30, Hotel Sherman, Chicago.

AMERICAN WELDING SOCIETY, 33 W. 39th St., New York 18—1954 National Spring Technical Meeting, May 4-7, Hotel Statler, Buffalo, N.Y. The 1954 Welding and Allied Industry Exposition will be held at the Buffalo Memorial Auditorium, May 5-8.

SHEET METAL CONTRACTORS ASSOC., 170 Division St., Elgin, Ill.—11th Annual Convention, May 10-12, William Penn Hotel, Pittsburgh. J. D. Wilder is executive secretary of the association.

MICHIGAN ENGINEERING SOCIETY—1954 Convention, May 7-8, Jackson. J. E. Wilbur is executive secretary.

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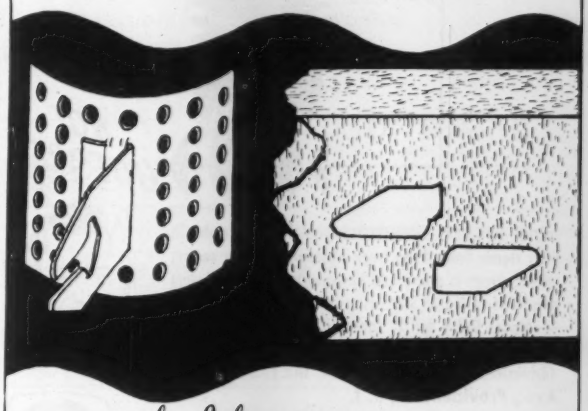

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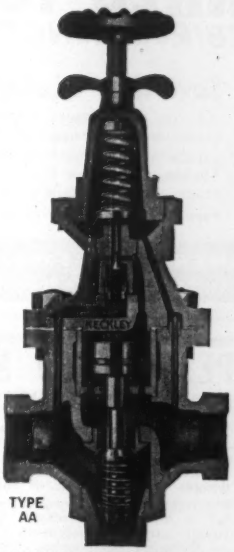

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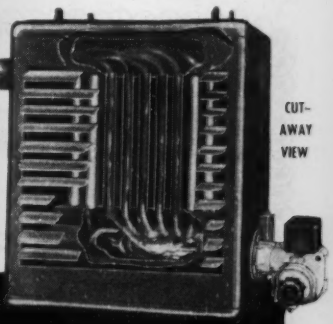

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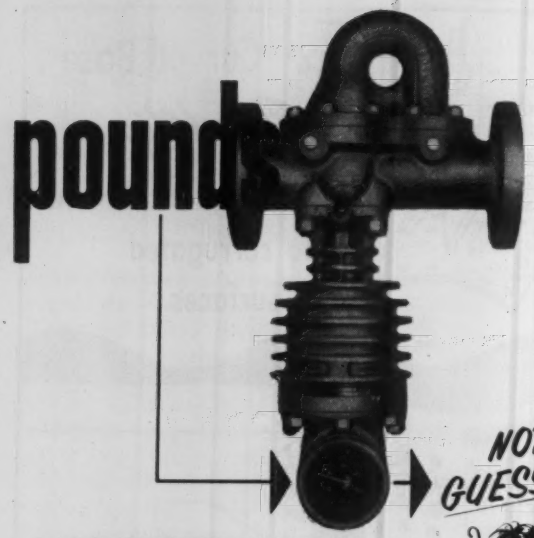

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PIONEERS IN METERS AND CONTROLS

MEETINGS & CONVENTIONS . . .

[*Continued*]

OIL HEAT INSTITUTE OF AMERICA, INC., 500 Fifth Ave., New York 36—32nd annual convention, May 16-20, to be held concurrently with the 1954 National Indoor Comfort Exposition. Both events will be held at the Commercial Museum, Philadelphia.

HEATING, PIPING AND AIR CONDITIONING CONTRACTORS NATIONAL ASSOC., Suite 1843, Rockefeller Plaza, New York 20—65th annual convention, May 24 to 28, Hotel Traymore, Atlantic City, N.J.

NATIONAL DISTRICT HEATING ASSOCIATION, 827 N. Euclid Ave., Pittsburgh 6—45th Annual Meeting, May 25-28, The Greenbrier, White Sulphur Springs, W. Va. John F. Collins, Jr., is secretary-treasurer of the association.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, 62 Worth St., New York 13—Semi-Annual Meeting, June 28-30, New Ocean House, Swampscott, Mass.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS, 40 W. 40th St., New York 18—41st Semi-annual Meeting, July 11-14, Hotel Olympic, Seattle, Wash.

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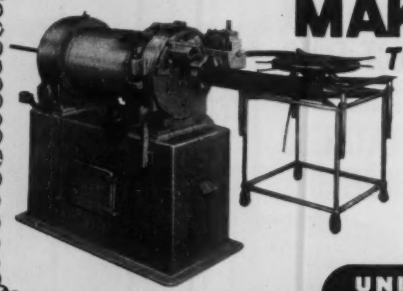

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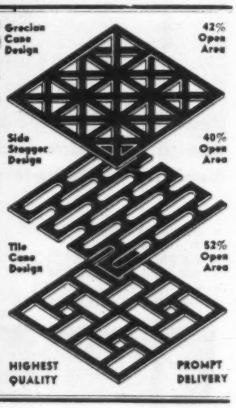

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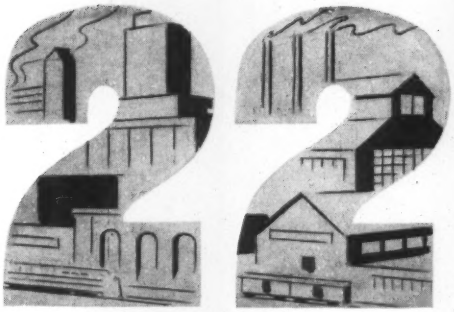

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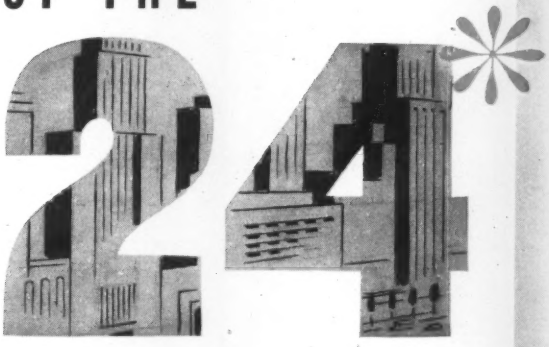

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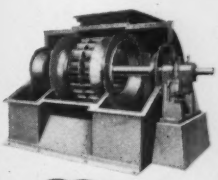

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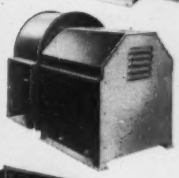

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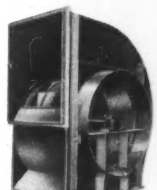

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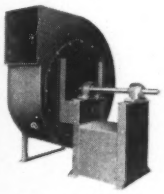

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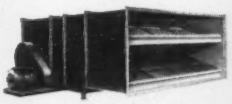

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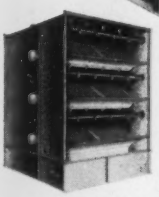

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The drawings show some of these No. 157 models that engineers, boiler manufacturers and contractors have asked for. Whatever you might need just name it and chances are we can pick it right off the shelf.

All of these No. 157 models are built around the famed McDonnell No. 150 Pump Control, Low Water Cut-off and Alarm. They represent the one right way to control the boiler feed pump — according to the boiler water itself. They are built from the word go to stand the gaff of high temperature and pressure—with completely packless construction, heavy duty mercury switches, all operating parts up out of the hot zone, porcelain bead insulation and many other refinements.

For complete information on the No. 157 models available write for copies of engineering drawings.

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McDONNELL No. 157

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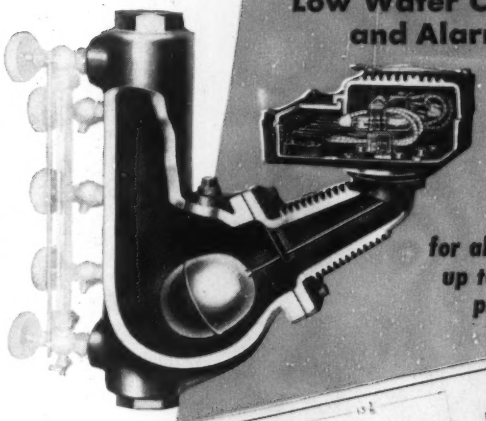
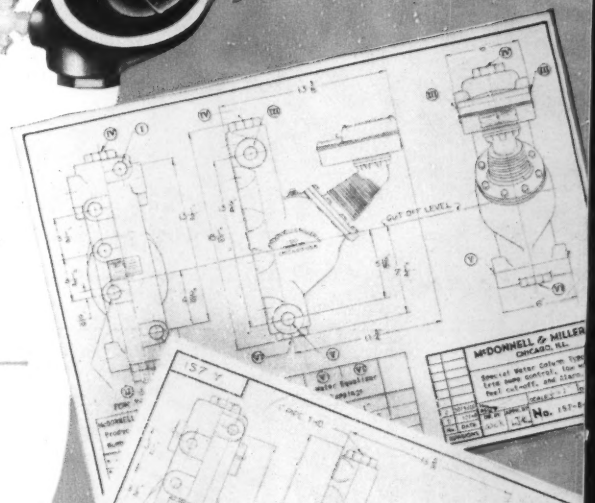


for all boilers up to 150 lbs. pressure



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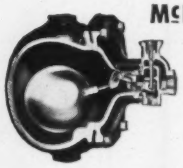
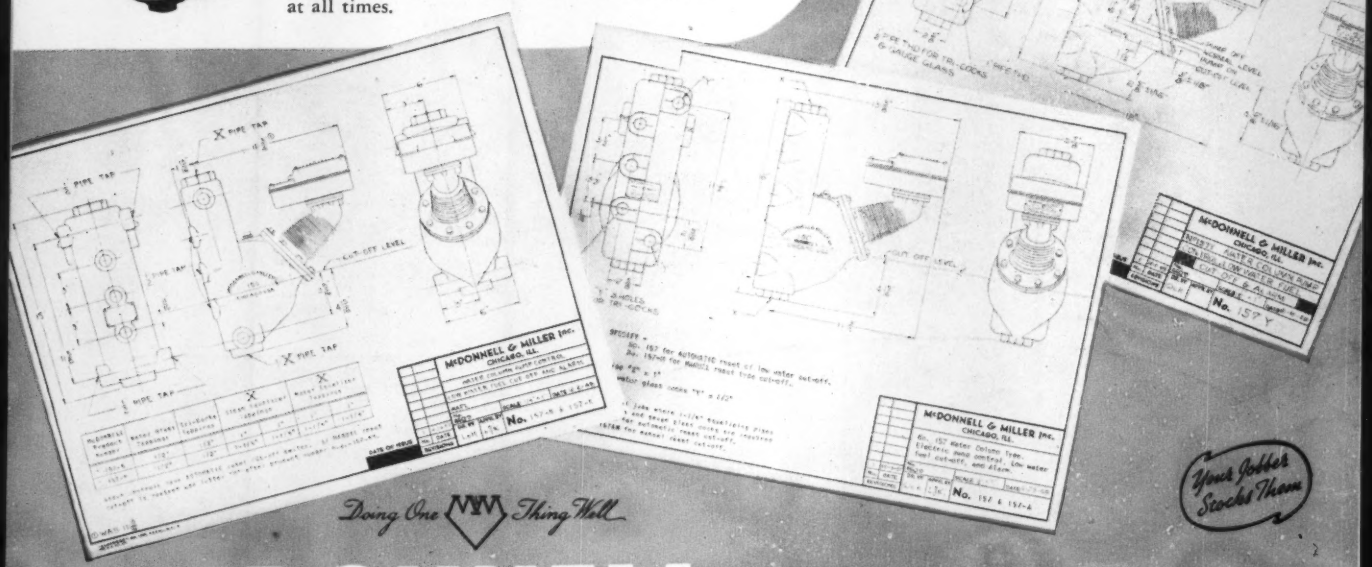


McDONNELL No. 27 Make-up Water Feeder

The No. 157 starts and stops pump as boiler water rises and falls — keeps the boiler level where it should be for maximum steaming efficiency. An ideal team-mate is the No. 27 Make-up Feeder, which adds water to receiver as needed to assure an adequate minimum supply at all times.



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